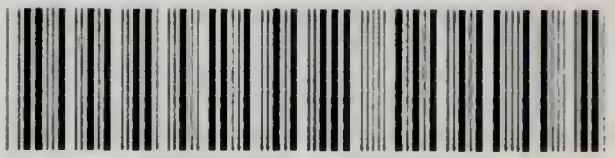

OXFORD MEDICAL PUBLICATIONS

# A HANDBOOK

FOR THE

# POST-MORTEM ROOM

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# A HANDBOOK

FOR THE

# POST-MORTEM ROOM

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# CHAPTER I

## INTRODUCTORY

Post-mortem examinations are made with three objects, first to lay bare the results of the disease so as to verify or determine the cause of death, secondly to see the processes of disease, and thirdly to acquire good judgement and skill in post-mortem work, the better to enable the student to interpret what he sees. The first of these objects concerns the physician or surgeon under whose charge the patient was during life; for his benefit we must if possible verify or contradict the conditions which by physical signs and symptoms he suspected during life; if an operation has been performed we must be prepared to demonstrate to the surgeon the success or failure of the technique and whether any further cause than that diagnosed during life contributed to the death of the patient. The second object concerns the teacher of pathology who by studying the stages of diseased states endeavours to body forth the processes of disease as they affect the patient during life. Here we are concerned with minute naked-eye anatomy, its verification by the microscope, and the underlying conditions to which these processes are due. As to the third point, the acquisition of skill, to determine what is abnormal the student must have continually examined the normal, and therefore it behoves him to examine carefully and

minutely in the earlier part of his course all the organs of the body and not only those that are diseased. The methods here dealt with are designed to cover the technique of all ordinary post-mortems that are likely to be met with in a general hospital, and it has been thought undesirable to include detailed methods for instances occurring with extreme rarity. For these and for methods of special research the student's own ingenuity would suggest methods or special articles must be consulted. The methods are those in use in the Post-mortem Room in the Radcliffe Infirmary, Oxford; they are based, as is most of this technique at the present day, upon the methods of Virchow as practised in most of the great schools here and abroad. Most of the descriptions of technique are founded upon dictations while actually making the dissection and preparations on the corpse. Modifications are introduced chiefly for bacteriological purposes and for the exigencies of teaching.

The order of the procedure may for special conditions have to be altered from that described, but under all circumstances possible the student is urged to adhere faithfully to the details of methods; this is important not only for the proper appreciation of the processes at work, but where a teaching department is in connexion with the post-mortem room slovenliness in method may spoil many a specimen which otherwise could have been preserved either as one to be handled or as one to be mounted permanently. The object aimed at is to expose everything possible at the time of the post-mortem examination so as to see the appearance of fresh sections and not to harden organs previous

to section ; on the other hand, the methods are designed to enable the natural shape and arrangement of parts to be restored as nearly as may be so that permanent preparations may be obtained if desired. Organs and pathological tissues should never be excised or displaced until their relations to all other organs and structures concerned have been ascertained.

In building up this knowledge of morbid anatomy the student should have in mind a clear distinction between fact and inference. In the earlier part of his work he must describe accurately what he sees, leaving the interpretation to those more skilled. With more and more practice and experience some latitude may be allowed, but if this be granted too early erroneous deductions may creep in. During his earlier period of post-mortem examinations, therefore, the student should note every feature from the gross to the most minute, this especially refers to surfaces natural and from section. Too much stress can hardly be laid upon the cultivation of 'microscopic eye'; many things which are ordinarily recognized under the low power of the microscope can also be identified by the trained eye, and for all purposes the simpler methods should be adopted. Some opinion should be attempted of the process in action, for otherwise mere description becomes useless ; for instance, the naked-eye features of the granulomata in themselves are useless unless they are of assistance in determining the causal irritative agent.

But while for purposes of acquiring skill every organ should receive attention, for the particular purpose of the post-mortem in hand the items of evidence in the

different organs should be arranged so that the processes of the disease are shown up in a systematic way and the pathological history of the disease sufficiently set forth to make the cause of death evident. It is, for instance, a waste of time, except to acquire knowledge, to make extremely accurate descriptions of every mark, mole, a slight scar on the skin, when the main seat of the disease has been internal such as tuberculosis of the lungs, whereas in an unidentified body or in a medico-legal case such evidence might be of the greatest importance. For the same reason and sometimes because time is limited it may be desirable to omit from the examination certain organs which are little likely to harbour general disease; this applies to the spinal cord and to such organs as the bones and muscles.

In the matter of the examination of organs and their exposed surfaces it is well to have a system upon which the examination is based in general. Variations will everywhere creep in, but the presence of such a method in the background will sometimes prevent the omission of an essential part of the examination. For the outer aspect of organs, whether solid or hollow, examine **local lesions, physical features, surface, ducts,** and **blood-vessels.** In local lesions are abscesses, tumours, ulcers, and such features as cannot fail to escape the eye on the first glance. The physical features should include size, shape, colour, and consistence; the weight of the organ is best estimated at the close of the examination. The surface should receive attention as regards its smoothness or roughness and the texture of the capsule; the ducts entering the gland should be felt and inspected. The method for examination of cut

surfaces and internal surfaces of hollow organs may be taken together, except that it is necessary in the case of hollow or tubular organs to note at once the content or presence of any secretions ; here examine for **local lesions, colour, texture of surface, consistence,** and **fluid content** (blood and otherwise). It is only further necessary to say that in inspecting any surface after noting its general features, its anatomical constituents should be inspected in turn.

In the matter of reports and descriptions of post-mortem examinations too long a time must not elapse between making the examination and the report ; wherever possible, especially in the case where minute naked-eye descriptions are included, the report should be dictated while the object is in front of the operator.

Finally, it should be mentioned that in a certain number of cases, though there may be a sufficient amount of gross disease the immediate cause of death is not obvious. In such cases we may suspect a chemical poison or some nervous agency. These will serve as a correction to the development of an overweening assurance in post-mortem diagnosis ; for it should always be borne in mind that though we know a great deal of the ordinary features of diseased organs, there is still scope for advancement, and opportunity if not for making at least for assisting the discovery of the causation of those diseases which are at present beyond our ken.

# CHAPTER II

## GENERAL ARRANGEMENTS FOR POST-MORTEM EXAMINATIONS

**Post-mortem room.** A room for the regular performance of post-mortem examinations should be built especially for the purpose; a room adapted from some other use always has some disadvantage, and in the interests of efficiency, cleanliness, and safety of those engaged in the work it is advisable that the conditions should be of the best. Seeing that a post-mortem room is one in which at times the most septic material may be contained and even distributed, the room should be constructed so that dirt of all kinds is least likely to be harboured, the floor and walls should be absolutely impervious to water, the former being preferably terrazzo, the latter, to the distance of at least six feet, of white glazed brick. The junction between the two should be a rounded angle; no cavity or corner in relation to any of the fittings such as sinks and wash-basins should exist which cannot easily and quickly be cleansed of any accumulation by water from the hose pipe.

The heating of the room should be by radiators. The ventilation should receive special attention; during the performance of a post-mortem more than ordinarily malodorous it may be advantageous to assist the

ventilation provided by the addition of an electric fan near one of the outlets. It should be specially arranged for that no odour emanating from the corpse should penetrate to other rooms. The post-mortem room, if it adjoins other rooms, should therefore be guarded by a double door, and the ventilation of the space outside these doors should be specially good.

Bright diffused daylight is the most suitable light for the work ; a large window facing north is therefore best ; if this cannot be obtained then a skylight with a north slope may be substituted or even added to the north window. All the fittings and walls should be white to make use of all available light as well as in the interests of cleanliness.

Post-mortems are not usually done in artificial light because colours cannot be rightly appreciated ; jaundice, for instance, may be entirely missed in artificial light ; but inasmuch as it might be necessary on rare occasions to perform a post-mortem by artificial light a good pendant with at least three bulbs should be provided over the post-mortem table, and side lights over each of the sinks, slabs, or wash-hand basins.

All fittings should be of the simplest patterns and such as to enable them to be kept scrupulously clean. The sinks, post-mortem table, basins, and slabs should all be of glazed white porcelain with no exposed unglazed portion underneath which would absorb moisture. These should be fixed and cemented to the wall, supported by enamelled iron brackets, so that the floor space underneath them allows no accumulation of dirt. The overflow to all these fittings should be simple in pattern so as to be easily cleaned. The post-mortem

table should have grooves in it leading to an outlet pipe at the foot, this leading through the enamelled iron pedestal to a sink in the floor. The best table is that made by Doulton's, of Lambeth, for the Rigs Hospital in Copenhagen. This table allows of a complete revolution, which is a great convenience. Water should be laid on to the table by a flexible pipe which can be used either for washing down the body or cleaning the table. A rather large square sink with a sloping fluted slab at one side of the room is necessary for opening hollow organs such as the intestines and for cleansing the organs just removed from the body. Water must be laid on to this and the outflow pipe must be large (2 in.) so as to allow lumps of fæces to pass down. This should be connected through a proper trap with the soil pipe. It is convenient to have a large porcelain slab on which a further examination or demonstration of organs may be made; this should be arranged near the best light. A second sink may be desirable for the purpose of a preliminary washing of the hands and arms in running cold water subsequent to the examination and for other purposes; but the main sink should be used as far as possible for all operations which deal with foul or septic matter. Two or three hand basins inside the post-mortem room are requisite in addition to those provided outside the room. These should have hot and cold water laid on so that the operator can wash his hands and arms in a running stream of water at any degree of warmth, and the taps should be arranged so that they can be turned on by levers operated either by the elbow or by the foot.

**Clothing.** It is unjustifiable for the person doing

a post-mortem examination to expose himself to any unnecessary risk of infection from the material that he has to touch. There is always some little risk when doing a post-mortem examination, say, on a case of anthrax or glanders or even cerebrospinal meningitis, if some of the material containing the organism inadvertently gains access to the eye or mouth or nose, and so renders an infection possible. The danger of infection, as well as its dissemination, is much more when portions of the clothes are exposed or when gloves are not used. The object, therefore, is to minimize to the utmost the area of contact of the corpse, or of any material from it, with the body or clothing of the operator. The clothing best adapted for the work is a white cotton coat and a large waterproof apron or overall. The cotton coat, which is put on after removing the coat and waistcoat, should have sleeves reaching to a point just above the bend of the elbow, and it should reach down to just below the knees. This coat should be frequently washed, at least once a week if post-mortems are being done regularly. The mackintosh apron should have flaps to protect the collar and should cover the whole of the front of the body as far down as the boots. (Messrs. Down Bros. make an apron of this pattern which serves the purpose well and can be boiled.) The hands should be protected by thin rubber gloves, such as are used in surgical operations, preferably of the pattern which is roughened on one side so as to prevent slipping. The hands should be first dusted over with boracic acid powder or French chalk before putting them on. If after doing the post-mortem the gloves are washed in soap and water while on the

hands, carefully dried, powdered with boracic acid or French chalk and then removed, they may be made to last a considerable time, even several months. In doing the rougher manipulations it is advisable to place over the rubber gloves some thin cotton gloves which will prevent spicules of bone from doing damage. These can be rinsed out in water after use, dipped in an antiseptic solution such as perchloride of mercury (1 in 1,000), and set out to dry, or they may be kept in this solution when not in use. Rubber goloshes, reaching above the bottom of the trousers, are an advantage in most post-mortems. At the conclusion of the post-mortem a preliminary wash should be done of the hands and arms up to the elbows before removing the mackintosh apron, and a thorough wash in soap and water subsequently. Hands and face should again be washed outside the post-mortem room before putting on the coat and waistcoat; and indeed, if the case has been very infective, such as glanders, arrangements should be made to have a bath. In many of the more newly built post-mortem rooms such is attached to the cloak room.

**Other Considerations.** It is desirable here to give a few directions as to what should be done if the hand be wounded by a knife or piece of jagged bone, or if the face or eye be accidentally sprinkled with infective material. For a small wound of the skin it is sufficient to remove any covering, allow the wound to bleed, and place it under running tepid water for three to four minutes, washing with soap and water the surrounding skin, then to immerse it in a solution of perchloride of mercury (1 in 1,000), or of

carbolic acid (1 in 40), and bind it up with a piece of gauze soaked in either of these antiseptics. If it be a hand another glove may then be placed over this and the work resumed. If, however, the cut is more extensive or lacerated, it is necessary to continue the washing for a longer time, and now and then to immerse in antiseptic solution. Spots of blood upon the face can be removed with a piece of clean gauze or the end of a clean towel soaked in water. If septic matter has touched the eye a piece of gauze or the end of a clean towel soaked in water should be squeezed out by a previously cleaned hand so that the drops fall into the conjunctival sac when the lower lid is pulled down. A few drops of $\frac{1}{2}$ per cent. silver nitrate from an eye-lotion bottle should then be dropped inside the lower lid.

Some post-mortem examinations are rendered less valuable because of post-mortem decomposition, all but gross change of the organs, especially those in the abdomen, being masked. To prevent this the place for storing bodies should be a freezing chamber ; with such it is not, therefore, imperative, as otherwise it would be in warm weather, to do the post-mortem at the earliest possible moment, and the conditions of post-mortem examination at these times are rendered much less unpleasant to the workers. It is convenient, especially for purposes of demonstration, to have a small chamber near the post-mortem room in which organs removed from the body may, if necessary, be preserved for some days at a low temperature.

# CHAPTER III

## INSTRUMENTS AND APPARATUS

### Instruments.

Just as for efficient surgical technique a number of different instruments are required for the varying conditions of the operation, so in post-mortem work we employ a number of instruments, each with its proper use. There may be some differences of opinion amongst pathologists on the exact pattern of instrument best adapted for a particular purpose, but the general requirements of the instruments are the same. The student will find that certain instruments are much more used than others, and it is in the interests of good work that he should familiarize himself first with those that are absolutely essential. Moreover, each instrument has its particular use for which it should without exception be used, and one of the objects of this section is to indicate those uses. The instruments here described are those with which a properly equipped post-mortem room should be provided, but the list of those absolutely necessary, e.g., to put in a bag for the performance of a post-mortem in a private house, will be found in the section dealing with special post-mortems (p. 130).

Post-mortem instruments need as much or more care than surgical instruments, for, inasmuch as they are

put to baser uses it requires additional precautions to keep them clean and sharp enough to allow of the work being performed efficiently. Modern instruments, for use in opening the body or for dissection can be obtained all of metal with none but necessary projections and with no crevices that cannot be easily cleaned. Such instruments can be sterilized by boiling, or, as in the case of knives which might be blunted by boiling, left for some hours in an antiseptic solution such as 5 per cent. carbolic acid. As soon as possible after use the instruments should be well washed in running water to rid them of blood or solid matter ; in the case of scissors, &c., they may be scrubbed with a brush in soapy water, rinsed, and carefully dried. This in the case of ordinary post-mortems is sufficient to keep the instruments in good condition ; if, however, the post-mortem has been very septic, as, for instance, anthrax, then all instruments that have been used should either be boiled or rendered aseptic by soaking in antiseptic for several hours, after which they must be washed and dried as before.

Steel instruments kept exposed to the air of the post-mortem room for more than a few days without being used will tend to rust and the knife edges to become blunt ; it is advisable, therefore, to have an instrument case with tight-fitting doors in the room for their proper reception, and in the case of instruments only occasionally used to keep them smeared with vaseline or wrapped up in paper.

Cutting instruments need frequent sharpening, and when post-mortems have to be done daily a spare set of those most in use is a convenience. No instruments

should ever be allowed on the same place as serves for the organs removed from the body; cutting instruments thus get hidden under organs and the hands may then get wounded. It is best to have an enamelled tray or plate on which all instruments should be placed when not actually in use.

Of **Knives** five kinds are in common use. First the broad-bladed so-called cartilage knife, with an open curved cutting edge and an obtuse-angled point (Fig. 1, *b*). It is used for the main skin incisions, for flaying the skin and muscles off the thorax, for removal of the thoracic organs in one piece, for stripping the mesentery from the bowel, and in general for removing all organs from the body where a broad blade will not restrict its operations. This knife may also be used for opening the organs when the more convenient 'brain' knife is not available. It is an advantage to have one of this kind specially for cutting through rib cartilages and for the disarticulation of joints. Secondly, the narrow-bladed sharp-pointed knife (Fig. 1, *c*) for use in the excision of organs when the broad-bladed knife is unsuitable, such as in the removal of the tongue, soft palate, neck viscera in the manner subsequently to be described, and in the removal of the pelvic organs. Thirdly, the 'brain' knife (Fig. 1, *a*)—a long, round-ended, thin-bladed knife, specially useful for making long incisions into big organs such as the brain, lungs, liver, and useful in making the main incisions into kidney, spleen, thyreoid, prostate, where a good surface is wanted. This is best obtained by a drawing movement of the knife from heel to point, without the application of much pressure, at right angles to the

edge of the knife. Fourthly, a blunt-pointed bistoury (Fig. 1, *d*), necessary for opening the dura mater,


Fig. 1. Reduced about $\frac{1}{3}$.

for severing the cerebral nerves, vertebral arteries, &c., in the removal of the brain, also in opening into the ventricles of the brain after the initial incision with the brain knife has exposed the upper parts of


FIG. 2.—Reduced about 1

the corona radiata. Fifthly, a small scalpel (Fig. 1, *e*), for use in finer dissecting operations, where a vessel, e.g. artery, vein, or thoracic duct, has to be freed from other tissues, and generally for all dissecting as opposed to cutting operations.

Of **Scissors** there are six varieties, three large and three small. First, the large blunt-pointed scissors for use in opening the œsophagus, trachea, bladder, stomach, &c., and for use where large incisions are needed (Fig. 2, *c*). Secondly, similar scissors with rather longer blades will be found of service in making some of the long incisions into the heart, as, for instance, in opening up the conus arteriosus and pulmonary artery, and in the corresponding incision on the left side (Fig. 2, *b*). The same incisions may without much difficulty be done by the first kind. Thirdly, large scissors similar to the first, but with one blade longer than the other and shaped as indicated (Fig. 2, *a*) ; this is for opening the bowel, and the longer blade is to prevent the bowel from slipping off the blades at each incision. Fourthly, large dissecting scissors with sharp points (Fig. 2, *d*). Fifthly, small blunt-pointed scissors for opening such smaller cavities and tubes as the bronchi, the urethra, the ureters, &c. (Fig. 2, *e*). Sixthly, small probe-pointed, thin-bladed scissors for opening up the finest tubes, blood-vessels, bronchioles, thoracic duct (Fig. 2, *f*). Small fine-pointed scissors are of use for finer dissecting work (Fig. 2, *h*). For opening the finest tubes, such as the thoracic duct, the author prefers another variety—a fine-pointed scissors with the points just rounded off (Fig. 2, *g*).

Of **Forceps** only three kinds are in common use.

First the ordinary blunt dissecting forceps (Fig. 3, *b*), for use both in dissection and in such operations as removal of the brain, holding up the pulmonary artery or aorta, in applying the water test to the pulmonary and aortic valves, and any action to which a firm grip of a small piece of tissue is required. Secondly, a


FIG. 3. $\frac{1}{6}$.

smaller pair of the same pattern for the finest dissections (Fig. 3, *a*). Thirdly, the so-called lion forceps (Fig. 3, *a*), for use when a firm grip of some bony structure is required, as in removing the laminæ of the vertebral canal for removal of the spinal cord.

Of **cutting instruments for bone** there are, first, the rib shears (Fig. 4, *a*), the thinner blade of which can be slipped under the rib cartilages without

wounding the subjacent structures when the cartilages are calcified. Secondly, bone-scissors or bone-forceps (Fig. 4, *b* and *c*), of which two should be provided, a large and a small; the former can be used to cut larger bone, such as vertebral spines, &c., and the latter to

*a* *b* *c*

Fig. 4. $\frac{1}{7}$.

cut smaller bones, such as the orbital part of the frontal, where the size of the larger tool would be a hindrance.

Of **Saws** for bony parts three may be used. The first is an ordinary amputation saw, with a broad steel blade cutting up to the point (Fig. 5, *a*); it is better to have this pattern than the band-saw clamped at

heel and top, because it is more generally useful, and can also be used for opening the spinal canal, which the other cannot. The second saw, or rachiotome, is not absolutely essential, but it saves a little time in opening the vertebral canal; it is provided with two parallel blades of a curved pattern and is arranged so


Fig. 5. About $\frac{1}{6}$.

that each blade cuts through a vertebral lamina when the blades are on either side of the vertebral spines (Fig. 5, *b*). The third saw is used in order rapidly to make sections of long bones; it is an endless band-saw made to revolve by a pedal.

For the removal of small pieces or plates of bone a strong steel chisel (Fig. 6, *c*) and a metal mallet

(Fig. 6, *b*) are necessary; as, for instance, in removing the orbital plate of the frontal bone to expose the orbit, for exposing the nasal cavities by removal of the cribriform plate of the ethmoid, and for completing the removal of the temporal bone after making the

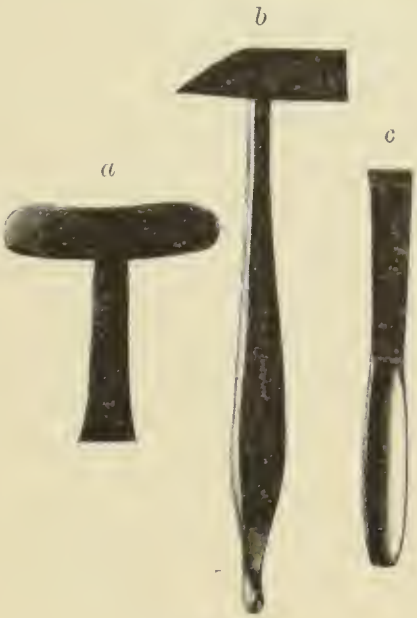


Fig. 6. $\frac{1}{6}$.

necessary incisions with the saw. Another and rather broader and shorter chisel, with a long T-piece at the end, is useful for completing the incision of the inner table of the skull in removing the calvarium (Fig. 6, *a*). The blade is inserted into the saw-cut in various places and the chisel gently knocked with the hammer; then using the ends of the T-shaped handle to turn the chisel while still inserted in the saw-cut, the calvarium can, if the inner table is nearly separated, be

completely loosened from its bony connexions. The remainder of the removal can be effected by pulling on the calvarium from behind or in front. This is best done by inserting a blunt hook, which is usefully fixed to the end of the handle of the mallet, under the edge of the now loose calvarium in the frontal region and wrenching the calvarium free from its attachment to the dura mater underneath.

Of probes and similar instruments it is desirable to have a small 5-inch silver bullet-probe for smaller arteries and ducts, and a larger 10-inch one, of similar pattern, for gall-ducts, ureters, &c. A medium-sized solid steel bladder-sound is often a necessary instrument in determining the relations of abnormal structures to the urethra and its orifice into the bladder. A medium-sized flexible catheter with a solid end is sometimes wanted to remove the urine from the bladder.

A bone-drill is useful in wiring together bones that have been sawn through, e. g. in fixing the calvarium on the cranium.

List of further necessaries :—

1. Balances for ascertaining the total weight of the body, for ascertaining the weight of the organs, and if reagents are to be made up, a chemical balance weighing up to 100 grammes.

2. For ascertaining measurements a steel rule, graduated in centimetres and millimetres, serves to measure the dimensions of organs; a steel tape-measure similarly graduated serves for the circumference of the head or a limb. Calipers are a convenience if the head has to be measured. For the length of the body

a graduated wooden staff with a fixed transverse piece at one end and a movable one at the other is required.

3. Different sizes of measuring glasses for obtaining the volume of fluids. Those of 100 c.c. and 1,000 c.c. are perhaps the most useful. A small cup or beaker is desirable for transferring fluids from the body to these vessels.

4. Three or four circular deep enamelled bowls of various sizes for holding the organs, such as the intestines, when removing them from the body, and three or four shallow flat-bottomed enamelled trays for transporting organs and for use as dissecting trays. Earthenware or glass vessels with lids for the preservation of organs.

5. Several marine sponges for removing fluid or blood from cavities and for cleaning internal or external parts.

6. A medium-sized packing-thread needle for sewing up the skin incisions, and some fine string ; pliers and medium-sized copper wire.

7. Cotton-wool and tow.

8. Plaster of Paris.

**Reagents.** Formaldehyde. A solution of 4 per cent. in 8 per cent. normal saline, is the most useful, though 10 per cent. may be required for more rapid penetration when organs of larger bulk are to be fixed.

Alcohol, 90 per cent.

Glycerine, 50 per cent.

Tincture of iodine.

Sulphuric acid, 25 per cent.

Carbolic acid, 5 per cent.

For methods of fixation which have special objects in view, works on histological technique must be consulted ; see especially Schmorl's *Untersuchungsmethoden* (Leipzig, 1912), and Mann's *Histological Methods* (Oxford, 1904).

# CHAPTER IV

## THE EXTERNAL EXAMINATION OF THE BODY AND THE METHOD OF REMOVAL OF THE ORGANS

### 1. The external examination of the body.

The care with which this is done depends upon the circumstances attending the death of the patient; if, on the one hand, the post-mortem is done in the ordinary routine of hospital work, then it may be presumed that the main external features of the body which might bear on the disease have been noticed and recorded in the clinical notes; but, on the other hand, if the history of the patient previous to death had only scantily been inquired into, as in a rapidly fatal accident, or if the body had been discovered dead and legal action is pending or likely, then the most searching and carefully noted observation of the external features must be made. At the same time it may be said that the external examination in all cases is just as much a part of every post-mortem examination as is the opening of the heart, and though it need not take more than a few minutes in the case of a person reasonably skilled in the work, it should be done step by step in a routine method. It should also be looked upon as giving the initial clue to the process of disease that has killed the patient.

**Obtain ante-mortem history of the patient.** Before beginning the examination it is necessary to ascertain what has been known of the case previous to death. In ordinary cases the clinical notes, or such an abstract of them as is pertinent to the needs of the examination, should be available, and this should include such necessary details as age, occupation, a description of an operation, if any, and the date and hour of death. The interval between death and the post-mortem examination is important in estimating how much may be attributed to decomposition, which is especially liable to be seen in hot weather, if the body has not been kept at a low temperature or if death has occurred from a condition in which many putrefactive bacteria can gain entrance into the tissues, as for instance in intestinal obstruction.

For the external examination the head of the corpse should be turned towards the source of light and the operator should stand at the right side of the body. This position need not be kept the whole time, for it will be necessary to examine the body from the opposite side or other aspect. It is a convenience, too, if the table can be revolved so as to be able to bring every part into the best light. The external examination may then be conducted in the following order :—

**General survey.** Notice the length and bulk of the body, whether there is a discrepancy between the age as stated and the appearance ; notice also the position of the body and the facial expression. The state of nutrition, the condition of the muscles and bones, whether equal on the two sides, the general coloration of the skin and hair, as well as any abnormal

smell, should be noted down. At this stage it may be necessary to ascertain the dimensions of the body in figures, the weight, the height from the soles to the top of the head, and any other measurements that the special needs of the examination suggest.

Post-mortem staining of the skin, lividity, or hypostasis can always be seen in the most dependent parts of the body; it is a dull reddish discoloration absent from the upper parts and from the lower parts where there has been pressure, e. g. on the shoulder-blades and over the buttocks or under bandages. It may be recognized further, because it disappears on pressure, showing that the blood is contained in the capillary vessels. Bruises and extra-vascular bleedings, such as in hæmorrhagic inflammations of the skin, do not fade on pressure, show colour zones with different tints and are not uniformly purple or bluish.

Rashes on the skin may entirely fade after death, owing to the disappearance of inflammatory hyperæmia, but if, say, a measles rash has been present a few days the skin may be slightly raised in the affected areas and pigmented or roughened.

The head and limbs should be moved in turn to determine the state of the body as regards rigor mortis and to ascertain whether there is a fracture or an abnormal increase or diminution in movement at any of the joints. Some degree of rigor mortis can usually be seen unless decomposition has set in. It begins in the facial muscles, travelling to the trunk, arms, and legs in that order; it disappears usually in the same order.

**Evidence of decomposition.** The evidence of

putrefaction can usually be detected, unless the examination is made very soon after death, in the greenish discoloration of the skin of the abdomen, which is due to the output of hydrogen sulphide by the intestinal contents and the formation of ferrous sulphide with the iron-containing substances, especially hæmoglobin. This is always seen on the lower surface of the liver where the colon comes into contact with it. If putrefaction has gone on further, discoloration may be seen in the cheeks around the nasal orifices.

The detailed examination of the parts of the body may then be undertaken.

**The Head.** Examine the head and the other parts of the body in a routine order ; begin with the skin and its appendages, then do the muscles, the bones, joints, next any orifices, and finally the sense organs. In the head, therefore, the skin should be examined in every part minutely, making a note of the colour consistence and blood supply, the presence of any thickening, scar, rash, bruise, ulcer, or wound. The hair and beard and any wart or skin excrescence should be examined. The muscles of the face do not often require a detailed examination, but the facial expression, whether the eyes are open or closed, and whether there is rigor in the temporal muscles, determined by the ability easily to open the jaw, should be included. The head should then be palpated over the bony parts for evidence of abnormality ; it might be desirable if the shape of the head were important or if the subject were a newborn babe, to measure the circumference, or to make those measurements which are usual in anthropometry or obstetrics, for the details of which special works

should be consulted. The orifices, the ears, mouth, and nose, which should be examined with reference to the condition of the lining membrane, the presence or absence of blood, secretion or abnormal content, and in the mouth the condition of the lips, teeth, gums, and palate.

Of sense organs, the eyes should be inspected as regards lids, conjunctiva, secretion, cornea, lacrimal orifices, colour and state of iris, and the intra-ocular tension.

**Neck.** In the neck proceed as before: examine the skin in front and behind, noticing any abnormal features, palpate the muscles, move the head on the shoulders, both to detect rigor and abnormal mobility in the cervical vertebræ. Palpate the tips of the cervical spines. Palpate also the soft parts underneath the skin, larynx, thyreoid, &c., in front and from behind.

**Trunk.** Examine the skin of the trunk carefully in front and at the sides. Note the amount of subcutaneous fat, examine the navel and the mammæ. The condition of the muscles can be noted from the general muscular development of the pectorals or from the thickness of the abdominal muscles unless the fat be too great. Pressure should be made on the thorax to detect any gross fracture or instability of the ribs; the bony framework of the chest should be palpated and the iliac, pubic, and sacral bones. The orifices and the organs connected with them consist of the anus and the genital organs. The anus should be examined for hæmorrhage, excretion parasites, hæmorrhoids, ulcers, or tumours.

**Genital organs.** In the male examine the general

aspect of the penis, the condition of the foreskin, glans, meatus, and the presence of secretion in any of theses pots. Examine also the scrotum, and the testes. In the female, separate the legs and note the condition of the labia, majora and minora, clitoris, hymen if present, vagina and perinæum ; note the presence of secretion, blood, or abnormal substance on any of these parts.

Turn the body over and make a careful inspection of the back: mark out the line of spinous processes of the vertebræ, palpate the bony points and the bones of the shoulder and hip girdles on each side.

**Arms.** Both limbs must be examined, the left before the right. Inspect the skin, hair, nails, and palms. Notice the position the limb tends to assume, the muscular development, comparing it with the opposite side, ascertain if there is any atrophy and the presence or absence of rigor. Palpate the bones for lack of rigidity, thickening, or abnormality of shape. Move all the joints, from the small finger joints to the acromio-clavicular and sterno-clavicular.

**Legs.** Of the lower limbs, inspect the skin, hair, nails, and soles, not omitting those parts which are not exposed when the corpse is lying on the back ; notice the position of the limb, the muscular development, comparing it with the opposite side, the presence of atrophy in any group of muscles, and the presence or absence of rigor. Palpate the bones and move all the joints. Examine both limbs.

**Signs of Death.** Some doubt may occasionally be felt from a general inspection whether the person is dead or not, and as it may be desirable to make certain

it is necessary to indicate the procedure. The most obvious signs are the cessation of respiration and of the heart-beat, the former by noticing the absence of any condensation of moisture on placing a piece of glass over the mouth, the latter by palpation of the heart or accessible arteries, or by failing to hear the heart-sounds by auscultation. The tension of the eye-ball is very much less than normal. A moderately tight bandage or ligature applied round a limb causes no peripheral congestion. To make certain it may be desirable before proceeding further to make an incision into one of the superficial arteries, such as the brachial or radial, to ascertain if any blood-flow exists.

## 2. Method of exposing and removing the viscera of the mouth, neck, thorax, and abdomen.

Arrange the body on its back so that the head is directed towards the source of light, and put a block of wood six inches high under the shoulders to extend the neck, then, standing on the right side of the body grasping firmly the broad-bladed knife, make a continuous incision through the skin and superficial tissues from the top in the middle line of the manubrium sterni [1] to the top of the pubic arch passing to the left [2] of the umbilicus.

[1] Beginners may use the most prominent part of the thyreoid cartilage as the upper limit of the incision.

[2] 'Left,' 'right,' &c., when referring to the structures displayed here and elsewhere always means that of the subject, not operator.

**The main incision.** Over the sternum the incision should go as near the bone as possible without blunting the knife, over the abdomen the incision should be just short of the peritoneum, all median or nearly median operation wounds should be utilized as part of this incision unless it is specially necessary that they should be preserved. Stretch open the incision with the forefinger and thumb of the left hand just below the xiphisternum, and incise cautiously till the peritoneum is reached, which must be cut through carefully so as to avoid wounding the viscera underneath. If the initial opening be made very small any gas contained in the peritoneal cavity will whistle through the opening. Pull upon the right lip of the incision with the left hand and enlarge the opening with the knife, cutting downwards in the direction of the original incision. When the opening is sufficiently large, insert the first two fingers of the left hand with their tips pointing towards the feet, and, raising the abdominal wall with one finger on each side of the line of the incision, cut through the rest of the tissues, using the two fingers of the left hand as a guide to protect the intestines underneath, and carry the incision to the top of the pubic arch, being careful to avoid wounding the bladder if it be full.

Facing the head end of the body hook up the right abdominal wall near the xiphisternum by the thumb of the left hand and separate off the abdominal muscles attached to the lower edge of the thorax as far as the anterior axillary line; with the left hand grasping the skin and muscle over the thorax and pulling it away from the body, separate off by bold sweeps the

pectoral muscles, skin, and subcutaneous tissues from the thoracic wall in front as far as the upper limit of the incision will allow. Facing the foot of the body, the left abdominal wall may be separated from the thorax as far as the anterior axillary line, and in a similar way the pectoral muscles separated from the thorax. A preliminary examination should then be made of the front of the thorax to see if the opening of the thorax can be carried out in the usual manner.

**Inspection of the Sternum.** Make an inspection of the thoracic wall thus displayed. Examine the organs in order : bones, cartilages, joints, muscles, glands, &c. Notice the general relation of the clavicles to the sternum, the shape and position of the sternum and the cartilages attached to it. Tap the bones with the haft of a knife and notice the sound emitted, and whether it is softened in any part. A projection of any part of the chest-wall or lack of symmetry will not be missed. Examine the sterno-clavicular joints by feeling them ; open them with the knife and notice the amount and character of any fluid that exudes. Examine each intercostal space in turn on each side. A special condition, such as an eroding aneurysm or a pointing empyema, would require careful inspection and description, and the sternum might be better removed in pieces. This is the stage at which, if it is suspected, to determine the presence of a pneumo-thorax. Make a little well over one of the intercostal spaces by getting an assistant to hold round it the skin and superficial fascia just stripped off ; fill this with water and with a small scalpel or trocar pierce the thoracic cavity and at the same time exert pressure on

the thoracic contents by pushing up the diaphragm on that side, when, if a pneumothorax is present, air will bubble through the opening.

**Removal of sternum and costal cartilages.** The sternum and the costal cartilages can now be removed; except the corpse is that of an old person the cartilages can be cut through with the broad-bladed knife, but if calcification is likely to be encountered it is safest to use the rib shears or bone-forceps. Cut through the second right cartilage close to the sternum, the third slightly farther out, and the remaining cartilages in a line running obliquely outwards, leaving about an inch of the cartilage attached to the bony part of each rib. Do the same on the left side. Raise the lower part of this triangular portion of the thoracic wall by placing the left thumb inside the thorax underneath the lower end on the right side and holding it well up, sever the attachment of the diaphragm to the sternum and rib cartilages on the right side.

Take firm hold of the right lower angle of this piece of the thoracic wall, carry the incision across the middle line, and dissect the pericardium and mediastinal tissues from the bone. Now go to the head of the body, draw the sternum to the left and towards the head and cut through the first rib cartilage on the right side, which will be found slightly lateral to the cartilages of the second rib; do the same for the left side, holding the sternum towards the right. Pull towards you the base of the sternal flap and with a narrow-bladed knife, cutting directly inwards above the first rib, sever the costo-clavicular ligament on the right side; rotating the blade so that its cutting-edge faces slightly

towards the head, sever the capsular and interclavicular ligaments of the right sterno-clavicular joint by an incision carried in a curve through the joint so that the blade of the knife ultimately points towards the head. Still holding the sternal flap in the left hand, the costo-clavicular, capsular and interclavicular ligaments can be severed on the left side ; the sternum and costal cartilages can now be freed with a few touches of the knife, and can be set aside.

**Removal of neck viscera.** Holding up the skin and muscle of the thoracic wall on the right side just below the upper end of the incision, insinuate the blade of the thin-bladed knife under the skin of the neck and strip off the skin and subcutaneous tissues from the viscera, carrying the separation as far backwards on either side as the vertebral column and as far upwards as the lower border of the mandible. Remove the block from underneath the shoulders and allow the head to lie flat on the table. Pushing up the knife from below, pierce through the floor of the mouth behind the symphysis menti and carry the incision to the right and to the left round the root of the tongue, following closely the inner wall of the jaw. This and the next procedure may be facilitated by opening the mouth and guiding the course of the knife by the sight. The tongue having been pressed a little back into the throat with the flat of the knife, pierce through the middle of the soft palate just behind the edge of the hard palate and carry the incision transversely outwards, first on one side then on the other, so as to cut in front of the glosso-palatal fold and tonsil ; carry this incision as deeply as possible and then

backwards. Push the left hand up underneath the skin of the neck and bring down the tongue as far as possible, and by putting the parts on the stretch sever the tonsils and soft palate from their attachments; when this has been done cut through the mucous membrane of the posterior wall of the pharynx by two cuts, beginning as high up as possible, curving down the posterior wall of the pharynx on either side. With a few more cuts on either side, the tongue can be brought outside below the upper end of the incision. Still pulling on the larynx, strip off the whole of the viscera from the bodies of the cervical vertebræ as far down as the posterior part of the first rib on either side. The carotid arteries will have been cut through above but their lower portions, together with the thyreoid, will be attached to the trachea and œsophagus, which is now separated as far as the upper opening of the thorax.

## Examination of the abdominal and thoracic viscera *in situ*.

**Thorax. Mediastinum and Pericardium.** Inspect the organs in the median line from above downwards: in the superior mediastinum the veins, the thymus, the lymph glands, the aorta, and the mediastinal connective tissue; in the middle mediastinum the pericardial sac. Open this by a longitudinal incision from the apex to the base of the heart and inspect the interior; notice the amount, colour, consistency of the fluid, inspect the lining membrane over the heart, vessels, and parietal layer. Make a small opening into the pulmonary artery and examine the contents.

**Lungs and Pleuræ.** Inspect the left and right pleural cavities; notice the amount of any excess of fluid and its colour and consistency, the presence of any adhesions and the general appearance of the pleural membrane, both the parietal and the visceral layers. Free the lungs of any small adhesions, draw them forwards and inspect the deeper parts of the cavities. Notice the condition of the upper aspect of the diaphragm. If, however, the lungs are firmly adherent to the parietal wall, strip off the parietal pleural membrane from the thorax so as to get the lungs free.

**Abdomen. General inspection.** If a little more exposure of the viscera is desirable than that obtained by the incision made, the recti muscles may be cut across transversely about their middle, taking care not to make a button-hole incision of the skin. View the contents of the abdomen generally and note if there is any abnormality in the position, size, or appearance of any viscus; if there is, dictate a description of what is seen. Take up the great omentum and examine both surfaces and its substance.

**The abdominal tour.** Examine the contents of the cavity as regards fluid and carefully examine the peritoneal surfaces for any adhesions. Inspect the main viscera by making a circular tour of the cavity; begin with the vermiform process and cæcum and follow up with the ascending colon, the gall-bladder, the pylorus, the small omentum, the spleen and left flexure of the colon, the descending colon and sigmoid colon, and finally the organs of the pelvis, including the contents of the recto-vesical pouch, the rectum, the bladder, and in the female the uterus, uterine tubes,

broad ligaments and ovaries. Inspect the small intestine with its mesentery, and the peritoneum.

**The rings.** Finally, inspect the depressions where herniæ are likely to be produced, the abdominal inguinal and femoral rings, the duodeno-jejunal fossa, the epiploic foramen.

**The removal of the thoracic and abdominal viscera. Thorax.** Stand at the head of the body and grasping the tissues of the superior mediastinum pull them over to the left ; insinuate the narrow-bladed knife under the anterior end of the right clavicle and cut round the inner border of the first rib as far as the vertebral column.

**Thoracic viscera.** With the thumb of the left hand push over the mediastinal tissues to the right and make a similar incision on the left side. The vessels passing to the upper limb are now severed. Standing on the right side of the body, pull the left lung and heart over to the right side with the left hand and make an incision through the pleura over the sides of the vertebral bodies ; push the viscera over to the left side, and do the same for the right side.

Take hold of the tissues of the neck just below the larynx and pulling towards the feet, not much force and only rarely a few touches of the knife are required to strip the whole of the posterior mediastinal tissues off the vertebral column as far down as the diaphragm. Pull the organs over to the right, free the lungs from any adhesions to the diaphragm, and cut through the aorta just above the spot where it pierces the diaphragm; pull the viscera still further over to the right, and the lower end of the œsophagus comes into view, cut through

this just above the diaphragm; pulling still further over, the inferior vena cava is the last important organ to be severed, the viscera can now be drawn clean out of the body attached only by the pericardial attachments to the diaphragm. In this position the slip of pericardium which lies over the lower rib ends may be severed and the whole mass of viscera is free. If, however, the pericardium has to be preserved intact, the diaphragm must be severed round it before cutting through the inferior vena cava, and its lower surface freed from the liver.

**Abdominal Viscera. Spleen.** Free the spleen from any adhesions that may be binding it down, draw it out and cut through the vessels at the hilus. It may be said here once for all that if the adhesions binding an organ to its neighbours or to the walls of the abdomen are very tough, it is safer to remove the organs so adherent in one piece so as not unduly to disturb the relations of the parts before dissection. A spleen, for instance, which is adherent to the stomach owing to the inflammation set up by the perforation of a gastric ulcer must be removed with the stomach. Remove the greater omentum by severing its attachment to the transverse colon.

**Intestines.** Next remove the small intestine; tie a double ligature round the jejunum just below the duodeno-jejunal flexure, and sever the intestine between the ligatures; then, holding up the lower end with the left hand, by a sawing movement of the knife held with the flat of the blade at right angles to the axis of the bowel, cut gradually through the mesenteric attachment of the bowel, and as the left hand draws up

successive lengths of intestine cut the mesentery as near the bowel as possible, for otherwise it may be difficult to open. As it is severed, the bowel should be put into a bowl placed on the table at the left side of the body, into which also the spleen and omentum as well as the other viscera should be put. In this way strip off the mesentery as far down as the end of the ileum. Now make a hole through the mesentery of the sigmoid colon and tie a double ligature round the gut just above the pelvis. After cutting between the ligatures, strip off the mesentery above the ligature in the same way as before, and on reaching the descending colon ease it carefully off the posterior abdominal wall by severing the peritoneum and retroperitoneal connective tissues where this is required. To dislodge the left flexure, take hold of the descending colon and the transverse colon together in the left hand, and pulling on them strip them from their bed, using the knife where necessary and cutting as near the colon as possible so as to avoid wounding the kidney. Cut off the transverse colon from its mesentery as in the case of the small intestine. Pull on the transverse colon below the right flexure and dislodge it by dissecting it off from its bed ; strip the ascending colon from the posterior abdominal wall, and on reaching the cæcum hold the terminal portion of the ileum and ascending colon in one hand, pull on them and sever their attachments, taking care not to damage the appendix. The greater omentum, if not removed previously, will have been removed with the transverse colon.

**Left kidney and suprarenal gland.** In suspected kidney, ureter, or bladder disease, these organs

should be inspected *in situ* and any abnormality seen should be described before removal. To remove the kidneys and suprarenal glands proceed as follows: Hold up the stomach and the left lobe of the liver, pulling them at the same time towards the right, cut through the peritoneum as near the top of the suprarenal gland as possible and carefully incising the retroperitoneal tissue the projection due to the suprarenal gland as it lies on the posterior abdominal wall will appear in view. With careful cuts isolate the outline of the organ, which can then be held in the finger and thumb and raised from its bed, but it should be left attached to the superior pole of the kidney. Incise the peritoneum along the lateral border of the kidney, insinuate the fingers underneath its outer edge and draw it inwards, thus stripping the posterior surface from its bed. The organ is now attached by the vessels of the suprarenal gland and kidney and by the ureter; the former can be severed by holding up the organ and cutting behind from without inwards, and on raising up the organ still further the ureter can be defined behind the fold of peritoneum thus raised up and by a few touches of the knife on the peritoneum it can be easily set free as far as the brim of the pelvis. Draw the kidney thus attached by its ureter downwards outside the abdominal cavity so that the ureter hangs over the inguinal ligament and the thigh.

**Right kidney and suprarenal gland.** The right kidney can be removed in a similar manner: raise up the right and lower border of the liver and define by a few gentle cuts the outline of the right suprarenal gland; sever the attachments at the edges and raise it

from its bed, incise the peritoneum at the right border of the kidney and pull the kidney medially ; hold up the kidney and cut behind it from without inwards until the renal and suprarenal vessels and nerves come into view. Cut these as far from the kidney as possible but avoiding injury to the aorta and inferior vena cava. Raise up the kidney and isolate the ureter from the peritoneal and retroperitoneal tissues as far as the brim of the pelvis ; leave the kidney attached by its ureter in a position similar to the left.

**Removal of liver, &c.** The rest of the viscera in the upper portion of the abdomen can now be removed together. Cut through the left trefoil and the diaphragm from before backwards, and do the same on the right side. Pull the left lobe of the liver over to the right and strip it off from the vertebral column beyond the median plane, below this strip off the pancreas, aorta, inferior vena cava, and the mesenteric attachments. Pushing over the right lobe of the liver towards the left, strip this off from the vertebral column and lower down the duodenum, pancreas, aorta, and vena cava. These organs are now free, except for the lower ends of the aorta and vena cava, which can be cut through just above the bifurcation, and they can be removed from the body.

**The pelvic organs. Male.** The method depends on whether the penis is to be removed or not ; the rule should be to remove the penis if there is any disease of the urinary or sexual organs. If no such disease is suspected then the urethra may be severed below the prostate as mentioned below. Put back both kidneys into the abdomen and identify the ductus

deferens as it courses over the left side of the pelvis, raise this from its bed as it approaches the internal abdominal ring and cut through the abdominal muscles from within so as to expose the inguinal canal. Push up the left testis from the scrotum towards the superficial inguinal ring, a few cuts over the projection made by the testis at the abdominal inguinal ring allows it to be pushed partly through the ring; it can now be grasped and with some of its coats detached from the lower end of the scrotum and isolated except for its deferent duct. Repeat this process for the right testis.

Chiefly by means of the hand, strip the bladder from the posterior surface of the pubic arch and isolate the prostate at the sides. Dissect off the skin and muscle from the anterior surface of the pubic bones until the root of the penis is exposed, continue the dissection by following down the arch of the pubis and sever as much as possible of the corpora cavernosa from them. Free the penis completely from the under surface of the pubic arch, and from within the pelvis seize hold of the penis and draw it upwards; in so doing the skin of the penis becomes invaginated. Identify the glans penis, and pulling on the skin the mucous membrane can be severed opposite the tip of the glans. Traction on the penis within the pelvis will now allow a more complete separation of the corpora cavernosa from the pubic rami, which should be complete. Pull forward the rectum and with the hand separate off this from the back of the sacrum as far down as the external sphincter, continue the separation from the pelvis round the sides of the bladder. Cut through the vessels and nerves supplying the pelvic organs and continue the

separation with the knife until the only remaining attachment of the organs is the rectum, which should be carefully severed as low down as possible. A little care is necessary to avoid wounding the posterior end of the corpus spongiosum. The whole of the pelvic organs, with the suprarenal glands, kidneys, and testes, are now free and may be removed for further examination. If the disease from which the patient suffered did not directly affect the urinary organs, then it is not necessary to remove the penis ; the pelvic organs may be removed from the pelvis by freeing the bladder from the front and sides, stripping the rectum from the sacrum, cutting through the pelvic vessels on either side and finally, as near the pelvic floor as possible, cutting through the rectum and the urethra just below the prostate.

**Pelvic organs. Female.** In the female subject separate the bladder from the posterior surface of the pubic arch and the rectum from the anterior surface of the sacrum. Continue the separation of the pelvic organs from the sides of the pelvis by the fingers, beginning from the neck of the bladder. The vessels and nerves entering these organs from the sides can be severed on each side by the knife, and with a little more dissection the organs will be free except for the urethra, vagina, and rectum. These should be cut through from the left side as near their external orifices as possible by pulling the organs slightly upwards. The pelvic organs are now free and can be removed from the body with the suprarenal glands, kidneys, and ureters.

### 3. Removal of the Brain and Spinal Medulla.

The brain is first removed and afterwards the spinal cord. Let the head rest on the extreme edge of the table or place a small block of wood under the neck. Standing at the head and facing the feet of the subject, turn the face of the corpse to the left and make an incision through the skin and subcutaneous fascia down to the bone over the mastoid process just behind the ear in the long axis of the body, and carry it transversely over the vertex to the same spot on the opposite side.

**Reflection of scalp.** If the subject be a woman it will be necessary to undo the side plaits by which the hair is usually retained and to make a parting along the line previous to making the incision. Pushing the skin of the anterior flap of the scalp forwards it can be dissected off the skull with the knife for a short way, the edge can then be turned forwards, everted, and by exerting tension forwards on this everted edge by the left hand, the loose connective tissue between scalp and skull can be either torn or cut through until the frontal bone is exposed nearly as far as the supraorbital ridges. A little dissection under the edge of the posterior flap will enable it also to be turned back upon itself, and by pulling it backwards, putting the connective tissue between scalp and skull on the stretch, this can be cut through with the knife until the posterior part of the scalp has been turned back as far as the external occipital protuberance. Any abnormality or condition demanding attention, either in the scalp or bone, will have been noticed during the process of stripping off the scalp.

**Removal of calvarium.** The whole calvarium is now removed by making a circular saw-cut in a horizontal plane, passing about half an inch above the supraorbital ridges and an inch or so above the external occipital protuberance, the incision passing through the frontal, the squamous portion of the petrous bone and the occipital. Before using the saw incise the

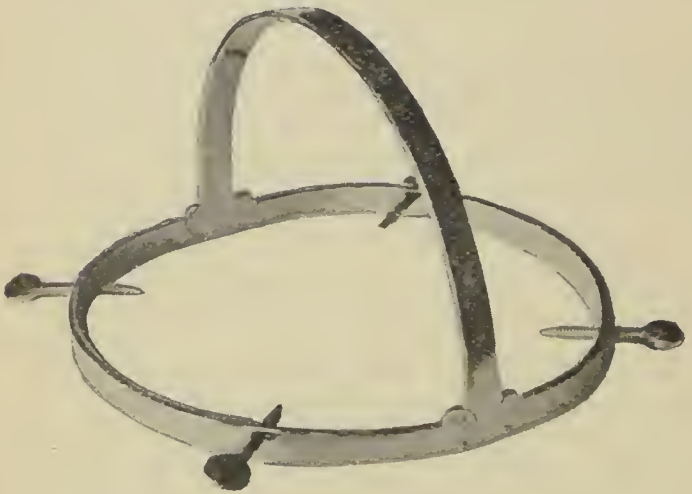

Fig. 7.

temporal muscle down to the bone along the line of the incision. In making the saw-cut, the head must be held firm, which may be done by having a small towel or dry sponge in the left hand and steadying the head by holding the vertex of the skull when sawing on the right side of the body, or by holding the face, covered by the scalp, when sawing on the left side. Another way is, by using what is termed a coronet (Fig. 7). This is a rigid frame which, by screws at intervals round a ring which encircles the head, can be fixed to the cal-

varium, the curved cross-piece lying antero-posteriorly can then be used to hold the skull in any required position, the saw-cut being so made as just to clear the metal ring. In sawing through the bone, the cut should not go deeper than the diploë between external and internal tables; this is easily detected by the saw entering softer tissue.

**Inspection of dura mater and brain** *in situ*. When the outer table has been completely severed, the inner table can be severed by inserting a cold chisel at one or two points; prising open the skull cavity by rotating the shaft of the chisel on its long axis and by pulling on the calvarium by a blunt hook, the bone can be entirely pulled off the dura mater. This is difficult in certain aged subjects because of adhesions, or in young children in whom the outer layer of the dura mater is the periosteum of the calvarium. The calvarium should then be inspected, noticing any abnormal attachment of it to the bone, the depressions made by the projecting arachnoidal granulations, the grooves for the accommodation of the branches of the middle meningeal artery, the sutures, and the presence of fracture. This is the stage in which to inspect the outer surface of the dura mater and the superior sagittal sinus; cleanse the surface of the dura with a damp sponge and slit up the superior sagittal sinus with fine blunt-pointed scissors from behind forward: notice the state of its contents.

**Removal of brain from cranial cavity.** The brain should now be removed from the cranial cavity. Pinch up the dura mater just above the frontal bone on one side and make an opening with fine scissors in

the line of the original saw-cut through the skull, and with a blunt-pointed bistoury continue the incision forwards as far as the superior sagittal sinus, and backwards as far as the transverse sinus; the same should be done the other side; at this stage any abnormal amount of fluid will escape from the subdural space. Pull up the right flap of the dura mater, insert the bistoury in the anterior end of the great longitudinal fissure of the brain, and sever the attachment of the falx cerebri to the crista galli of the ethmoid bone; the dura mater can now be completely reflected back from the hemispheres at the subdural space, the only attachment being a few delicate fibres and the arachnoidal granulations in the neighbourhood of the superior sagittal sinus, which can be dislodged from their beds in the dura by gentle traction, and the veins of the vertex as they enter the superior sagittal sinus. Take a glance at the general appearance of the hemispheres as they lie in their natural cavity, whether, for instance, they are of equal size, flattened, show any protuberance, wound, or hæmorrhage. Dictate a note if necessary. Now raise up gently with the fingers of the left hand the frontal lobes, if possible without damaging the olfactory bulbs and nerves which should be raised from their ethmoidal bed at the same time; raise them until the optic nerves come in sight; cut these through on either side just as they enter the optic foramina; cut through also the internal carotid artery which lies just behind and externally, and the stalk of the hypophysis cerebri passing to the middle of the fossa hypophyseos. The oculomotor and trochlear nerves now come into view and should be severed close

to where they disappear under the dura mater at the sides of the cavernous sinuses. Draw the hemispheres over to the left side so as to expose the tentorium cerebelli and sever through its attachment to the edge of the petrous portion of the temporal bone as far laterally as the squamous portion, and do the same for the left side. The nerves issuing from the pons and medulla oblongata will now come into view and should be severed as near their cranial foramina as possible. The abducent nerves from the top of the ventral aspect of the pons must be severed near to where they enter the wall of the cavernous sinus; the trigeminal nerves as they dip under the dura mater on the antero-lateral surface of the petrous bone if they have not been severed in detaching the tentorium cerebelli; the facial and acoustic nerves as they enter the internal acoustic meatus; the ninth, tenth, and eleventh, as they pass towards the jugular foramen, and the twelfth as it enters the anterior condyloid foramen. It now remains only to sever the vertebral arteries as they come upwards and inwards to form the basilar artery; this should be done by inserting the blunt bistoury in the vertebral canal at either side of the medulla oblongata, and cutting them close to the laminæ of the cervical vertebræ. The spinal medulla can now be severed, as low down as possible, by inserting the bistoury down the vertebral canal through the foramen magnum. The brain is now free from its connexions and may be removed to the table where the examinations are made.

For the removal of brain in infants reflect the scalp as for adults, but carry the scalp incision a little farther back, as the reflection of the longer anterior

flap is not difficult and the incision is thereby rendered less obvious. Insert the point of one blade of a stout scissors through the fibrous tissue over the anterior fontanelle and slit up the superior sagittal sinus by dividing the tough fibrous tissue in the median line of the frontal and interparietal sutures. Inspect its interior and its contents. Complete the separation of the bones by cutting through its lower wall. Separate in the same way the parietal from the frontal bone on each side and the parietal from the occipital as far as the temporal bone. The bones forming the calvarium can now be drawn apart, and these being held by an assistant, the brain can be removed as in the adult. By this procedure the dura mater, forming as it does the inner periosteum, is left attached to the bones. To restore the parts fill up the cavity of the skull with wool, rags, or soft paper, press the bones into their natural position and replace the skin flaps.

The removal of the spinal medulla is a procedure which may occasionally be omitted from routine post-mortem examinations. In the case, for instance, of patients dying from surgical diseases such as hernia or acute appendicitis, and even in some acute medical diseases, such as pneumonia, the examination of the spinal medulla may not, for the purpose of elucidating the disease, be required. The spinal medulla should always be examined in cases of brain disease, and it would of course be a routine procedure in the case of post-mortems done in a hospital for nervous and mental diseases. The student should always examine it where time permits, if only to acquaint himself with the naked-eye anatomy of the vertebral canal and spinal medulla.

The subject must be turned over so as to lie on its face, the head should be allowed to fall over the edge of the table, and a block placed under the abdomen so as to straighten out as much as possible the curve of the lumbar vertebræ.

**Incision for removal of spinal medulla.** Standing on the right side of the body, make an incision with the broad-bladed knife in the middle line of the back from the last lumbar spine to the external occipital protuberance. Beginning from below upwards on the right side and from above downwards on the left side, strip off the muscles, tendons, fascia, and skin in one piece, from the spines and laminæ of the vertebræ as far as the tips of the transverse processes. Then with a saw or rachiotome cut through the laminæ on each side as near to the transverse processes as possible, from the bottom to the top of the incision, directing the blade slightly medially if the single saw be used.

**Removal of the neural arches.** The blade of the saw may with advantage have a convex curve so as the better to enable the laminæ in the lumbar curve to be cut through. When the saw-cut has been made as deep as is thought to be sufficient, one of the spinous processes of the lumbar vertebræ may be seized with 'lion' forceps and with its two laminæ raised from its seat by scissors and bone-forceps; if an assistant, holding on to the spine and laminæ in the grip of the lion forceps, exerts traction towards the head, the bone-forceps, with one blade inserted into the vertebral canal, will easily complete the separation of the roof of the vertebral canal on either side as far upwards as the third or second cervical vertebra. The arches of the first

and second cervical vertebræ will need to be cut through with bone-forceps.

**Inspection of the vertebral canal.** Examine the interior of the vertebral canal, notice the condition of the perithecal tissues, the condition of the internal surface of the vertebral canal and the outer surface of the theca of the spinal medulla. Using small blunt-pointed scissors or a blunt-pointed bistoury, cut through on either side from above downwards the spinal nerves as near as possible to the lateral foramina and the lateral spinal ligaments; attach a thread to the first cervical nerve so that any nerve-root may be identified. The sacral nerves, and the filum terminale, unless the sacrum has been opened up behind, will have to be severed as far down as possible.

**Removal of spinal medulla.** Raise up the dura mater as low down as possible with forceps and open into the cavity by making a transverse incision; cut across the sacral nerves and the filum terminale with scissors, and complete the transverse incision of the dura mater. It now remains to sever the attachment of the spinal theca to the posterior longitudinal ligament of the vertebral column, which can be done with a few touches of the knife when raising the spinal medulla from its bed, and to detach the theca from its firm attachment to the bony ring of the foramen magnum it should be severed as near the bone as possible. Remove the cord from the body. In all manipulations the spinal medulla must be treated with the utmost gentleness, or the parts may be damaged, especially the grey matter, which by injury in removal may be made to simulate degeneration.

# CHAPTER V

## THE EXAMINATION OF THE ORGANS AFTER REMOVAL FROM THE BODY

This can most suitably be done on a slab adjoining a large sink, so that the contents of hollow organs and blood may quickly be removed and the exposed surfaces of the organs washed; after the main dissection has been made they may be removed to a more convenient place, which is to be recommended if more than one post-mortem is being done at the same time, so as to avoid mixing up the organs of one body with another. The more necessary instruments required, which are heart-scissors, bowel-scissors, small blunt scissors, probe-pointed scissors, forceps, brain-knife and probe, should be placed in a tray on some place easily within reach; the instruments should on no account be laid down with the organs.

As regards the order in which the organs should be opened up, it is preferable to begin with that organ or system which is the seat of the diseased process, beginning with the part most affected. The advantage of this is, that having determined what is the process at work, the other organs may be more intelligently examined in that special relation; it also has the advantage that the main cause of death is quickly exposed, which, in hospitals where no special time is

set apart for demonstration, is a convenience to the clinicians. It has the disadvantage, however, of requiring a new order for each post-mortem, but this can be minimized by following a definite order as soon as those organs chiefly diseased have been looked at. The order of the description that follows should be adhered to whenever the organ likely to be affected has not been made evident in the wards or in the initial steps of the examination; it is (1) Brain and spinal medulla, (2) Heart, (3) Cervical and Respiratory Organs, including the mouth and cervical organs and aorta, (4) Liver, stomach, pancreas, &c., (5) Intestines, (6) Urinogenital organs.

## Brain and spinal medulla.

The external examination must first be done in a thorough and systematic way. Notice first the main general features of shape; take the brain in the two hands and by turning it round obtain a view of the upper and under surfaces, the lateral surface and the cerebellum and posterior parts; notice any prominence or depression anywhere, and any disparity between the proportions of the two sides.

Now place the brain with the under surface directed upwards, the medulla pointing towards you, and make a systematic inspection of the parts displayed. Notice the condition of the meninges over the surface of the convolutions, over the cisterna pontis and over the pons and medulla oblongata, whether glistening and translucent, and the condition of the blood-vessels of the meninges. Strip off a portion of the pia-arachnoid membrane to determine how firmly the membrane is attached to the

parts beneath. Pass in review all the cerebral nerves, trace them as far as their superficial origin and examine from below backwards the structures present : olfactory surface of frontal lobe, optic chiasma and tracts, if these were not examined with the nerves, stalk of the hypophysis cerebri, corpora mammillaria, crura cerebri, the under surfaces of temporal and occipital lobes, pons, medulla oblongata, and commencement of the cervical spinal medulla. Glance also at the hippocampal fissures on the two sides. Now trace out the vessels; identify the basilar artery and the two vertebrals on the medulla oblongata, notice the condition of their walls and their contents, and whether the vessels are lengthened; from these trunks trace the main branches for a short distance, posterior and anterior cerebellar and posterior cerebral. Lay bare the arterial circle of Willis and trace up the anterior cerebral for a short distance. The middle cerebral, which comes off close to the spot where the internal carotid has been cut off, must be followed into the lateral fissure and its condition carefully noted ; this also affords an opportunity of seeing the condition of the meninges in these parts, which are specially important in the search for miliary tubercles in tuberculous meningitis.

Now turn the brain so that it lies with the upper surface uppermost, the medulla oblongata pointing towards you, and survey the parts exposed and those adjacent. Notice again any lack of symmetry in the hemispheres or flattening of the convolutions. Open up the great longitudinal fissure which has been begun from below in following the anterior cerebral arteries, and examine meninges, blood-vessels, and brain-structures in turn.

Notice near the median fissure the arachnoidal granulations, and beware of mistaking them for miliary tubercles. It may be said here that miliary tubercles are to be looked for away from the median fissure and at the sides of the small branches of the middle cerebral arteries. Unless these parts be systematically examined in all brains it will be extremely likely that normal or other meningeal thickenings will be mistaken for them. A portion of the pia-arachnoid over both sides should be stripped off from the convolutions ; if this can be done easily it is evidence of œdema fluid under the membrane ; if, however, the membrane strips with difficulty, leaving a roughened or 'frosted' surface or an actual laceration, it is to be inferred that there are adhesions, between the membrane and the cortex.

Finally, raise up the occipital lobes and examine the membranes, blood-vessels and brain substance of the upper and under surface of the cerebellum and the upper surface of the medulla, pay particular attention to the pia-arachnoid in the anterior end of the vermis, examine also the superior and inferior medullary velum.

With the convexity of the brain uppermost and the medulla pointing towards you, insert the blade of the brain-knife in the longitudinal fissure and make a horizontal cut towards the left just above the corpus callosum ; the left hand may be laid on the left cerebral hemisphere to support it, but the incision should stop short of making a complete severance of that part from the rest ; it should be carried just far enough to enable the cut to be opened out so that ultimately the upper surface of the detached piece will rest on the table.

Make a similar incision on the right side. Bisect both of these pieces longitudinally from the inner aspect without making a complete severance (Fig. 8). The corona radiata is now exposed where it lies above the lateral ventricles, with the radiations and fornices of the corpus callosum; examine the exposed surfaces. Take the blunt bistoury and make two curved incisions over the lateral ventricles not deeper than a centimetre, with the convexity of the incisions towards the middle of the great longitudinal fissure but not nearer to it than a centimetre or a centimetre and a half. These incisions should open into the lateral ventricles of each side, which should now be completely opened up, the anterior horn by continuing the original cut forwards and laterally round the end of the caudate nucleus, the posterior horn by continuing the original incisions in a curved direction inwards and backwards towards the occipital pole, and the descending horn for a short way downwards as it curves downwards and forwards from a little behind the middle of the main part of the ventricle (Fig. 8). Examine the contents and the lining membrane; the former should be a small amount of clear fluid and the latter should be smooth and glistening. With a sharp scalpel cut transversely through the corpus callosum opposite the interventricular foramen, being careful not to sever the columns of the fornix underneath; take hold of the posterior section of the corpus callosum and separate it from before backwards from the body of the fornix underneath, using the knife or scissors when necessary. The body of the fornix lying upon the choroid tela of the third ventricle is now exposed and should be examined; it is often very much

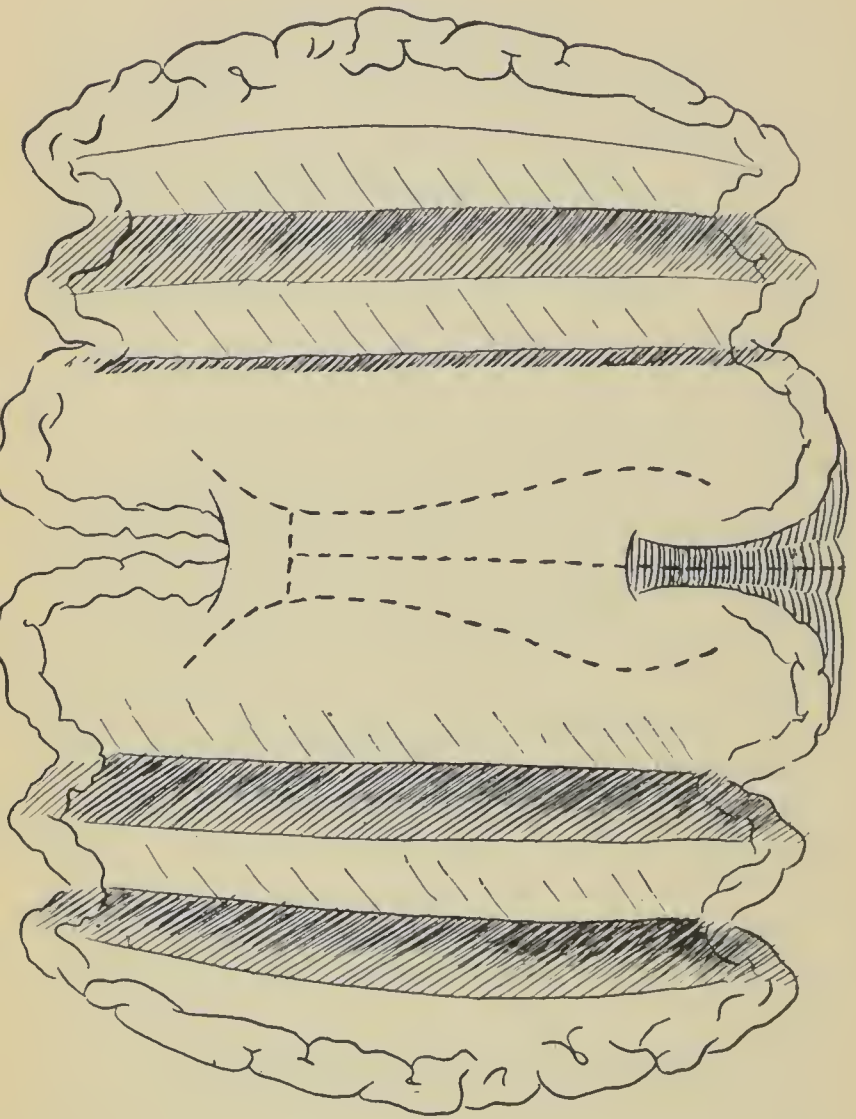

FIG. 8.

softened. Cut across the columns of the fornix at the interventricular foramen and reflect them back in the same way as the corpus callosum. Inspect the choroid tela of the third ventricle and the choroid plexuses *in situ*. Insert the end of the blunt-pointed bistoury in the interventricular foramen one side and through the other side and separate its anterior attachment; it can now be drawn back, leaving the third ventricle, middle and posterior commissures, and the stalk of the pineal body exposed. Make an inspection of the surface of the organs exposed, the caudate nucleus, thalami, hippocampus, and boundaries of the third ventricle. Free the pineal body from the choroid tela of the third ventricle; open up the aqueduct of the brain from above, cutting through the pineal body and its stalk and between the superior and inferior corpora quadrigemina and lower down the trochlear nerves as they cross in the median line. Continue the incision through the vermis of the cerebellum, including superior and inferior medullary velum, and the whole of the ventricles of the brain with their connexions are exposed and can be examined. Take a scalpel or the brain-knife and divide up each half of the cerebellum by making an incision outwards from the lateral angle of the fourth ventricle through the greatest diameter. Beginning from the lateral angle again divide up each quarter of the organ by two cuts directed forwards and laterally, backwards and outwards, respectively on each side (Fig. 9). Now examine, in turn, the aqueduct of the brain, the floor and lateral recesses of the fourth ventricle and the surfaces exposed by the cerebellar cuts, including the cortex, the white matter, and the dentate nuclei.

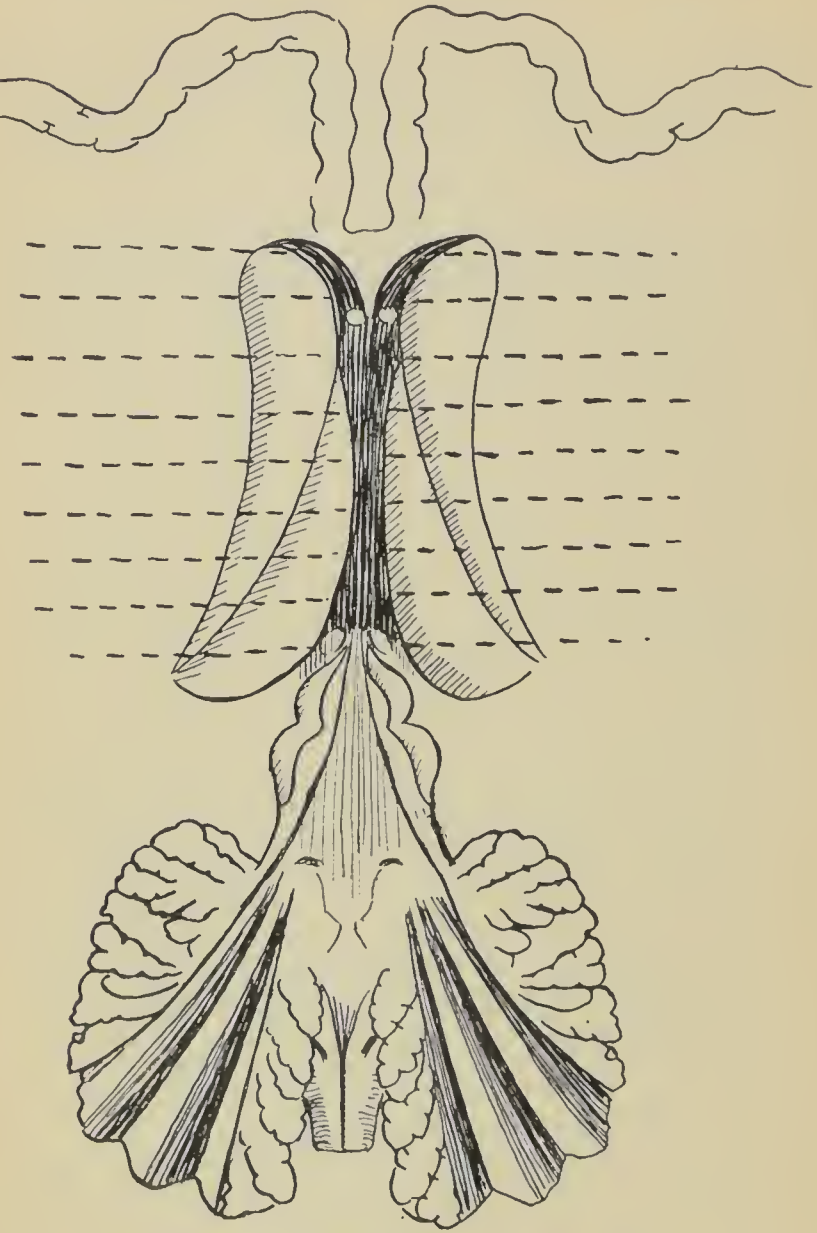

FIG. 9.

The internal structure of the basal ganglia may now be examined. Take the brain-knife and make vertical transverse cuts through the left side, beginning just behind the tip of the caudate lobe and ending just in front of the tip of the pulvinar. The lateral limit of the cut should be short of the cortex, and the sections of the basal ganglia made should, if possible, be only a few millimetres thick. A sharp knife is one essential for this, practice does the rest; if the sections are thick then minute hæmorrhages in this region may be missed. Repeat this on the right side. It is convenient when the knife has reached its deepest part in each cut to bring it back so that the edge of the knife lightly scrapes the posterior surface of the section, freeing it of blood and laying it slightly forward so that its surface is more easily visible. The caudate nucleus, the corpus striatum, the lentiform nucleus, the internal and external capsules, the optic chiasma, and the insula are thus exposed.

The lesions most commonly met with in this situation are hæmorrhage and softening; hæmorrhage is obvious by reason of its ploughing up the brain matter, or if small by seeing it in the lymph space which surrounds each small artery. Softening, which may be met with in any situation, is best detected by allowing a thin stream of water issuing from a rubber tube, such as is used for cleansing the surface of organs, to drop from a height of six to ten inches on to the suspected portion of brain matter; ordinary white matter, unless much decomposed, can stand this, but softened white matter is quickly ploughed up by it. This test should not be omitted in cutting up the basal ganglia.

The next step is to replace the parts of the brain into their natural positions, and to turn the brain over so that the medulla oblongata and pons lie uppermost; no portion should have been separated in the preceding dissections. Support the pons and medulla oblongata on a finger of the left hand and make successive sections from the top of the pons to the end of the cervical portion of the spinal medulla which remains in continuity, taking pains not to sever completely the dorsal part of the section; the structures in these sections can easily be identified in a fresh brain; note any departure from the normal.

In the event of the foregoing examination having revealed nothing of importance and the case is one which has suggested a possible brain disease, the brain may be placed with its under surface beneath and successive sections about 1 cm. thick made transversely from the frontal to the occipital pole.

One end of each segment should be carefully scrutinized. Notice the general outline of the section and the position of the central white matter, the relative areas of white and grey matter, and the shape of the latter. Whether the white matter everywhere has its normal colour, and if there are any areas of a different colour or consistence not respecting the limits of white and grey matter. Is there symmetry between the two sides? Is the white matter deficient in whiteness anywhere?

**The spinal medulla.** Lay the spinal medulla with its membranes straight on the table and inspect its anterior, posterior, and lateral aspects. Beginning from the top, using forceps and small blunt-pointed

scissors, make a median incision completely down the length of the dura mater anteriorly and posteriorly. Reflect the dura mater from the median line on either side anteriorly and posteriorly. Inspect the spinal medulla as a whole, notice the shape and proportions of the cervical and lumbar enlargements and the dorsal part. Carefully examine both the inner surface of the dura, which should be glistening, and the surface of the spinal medulla with the arachnoid and pia mater. Examine the anterior and posterior roots from their superficial origin to the spot where they pierce the dura mater; notice any shrinkage, swelling, or reddening. Now examine the cord itself carefully from above downwards, anteriorly and posteriorly, noticing any shrinkage, swelling or reddening, or thickening of the pia mater. To examine the interior of the spinal medulla, lay it on the left hand with an inch or so of the cervical portion projecting from the left forefinger, then with a sharp scalpel make a transverse section, cutting down just clear of the forefinger; the spinal medulla can then be worked up in the hand and another section made at about a centimetre lower down; do this for the whole length of the spinal medulla.

Examine two or three cross-sections in each of the three main regions of the medulla. Gross lesions, such as hæmorrhages, will immediately attract the eye and should be described at once; failing these, notice the outline, the position, of the central canal, and whether the two halves of the spinal medulla are symmetrical as regards general shape and as regards the relations between grey and white matter. Notice if the white matter is softer or harder in one part than another,

and whether it shows any greyish tint. What is the blood content? Normally, only the vessels in the pia mater or its prolongations contain visible blood. In suspected spinal disease the whole should be immersed in one of the special reagents for examination of the nervous system, such as Müller's fluid or Formol Müller.

## Examination of the Cervical and Thoracic Organs.

If it has not already been done before removal from the body, the pulmonary artery should be opened with scissors by an inch-long incision in its long axis, to ascertain if there be any embolism; normally it is either filled with gelatinous clot which can easily be pulled out of its branches and often shows the shape of the vessel, even to the construction of the semilunar valves, or it is filled with fluid blood containing air bubbles.

**Thoracic duct.** The thoracic duct must be opened at this stage; but it is unnecessary to do this unless special circumstances suggest it; such are (1) miliary tuberculosis in which the general infection may have gained an entry to the circulation by the ulceration of a caseous gland into the duct; (2) conditions in which there has been obstruction in the duct, such as chylous ascites and chylo-thorax. To find the duct, lay the organs anterior surface downwards with the tongue pointing away from you, and search on the left side of the œsophagus between this and the aorta. The vena azygos minor is liable to be mistaken for it; but the destination of the duct, the junction between left internal jugular and left subclavian veins will serve to

distinguish it. Slit up the duct with fine scissors and examine carefully its inner surface.

**Separation of the organs.** The heart and the lungs can now be separated from the cervical organs. With the tongue pointing away and the anterior surface of the organs facing upwards, slip the forefinger of the left hand through the transverse sinus of the heart from right to left and exert a little tension on the aorta and pulmonary artery which lie on the finger. Put one blade of the large blunt scissors through the sinus above the finger from the left side and cut through the arterial trunks as near the pericardium as possible. Now seize the heart with the left hand and hold it up so as to put its other vascular connexions on the stretch; cut through successively the two left pulmonary veins, which can be identified as they pass to the left lung; then with small scissor-cuts sever the connective tissue that binds the left atrium to the posterior and superior mediastinal tissues. In doing this the scissors should follow a curved course, first downwards towards the table and then towards the operator's left hand, gradually raising the points of the scissors so as to follow the curve of the wall of the left atrium. On reaching the site of entry of the right pulmonary veins these should be severed separately, and finally the superior vena cava at its entry into the pericardium. To separate the lungs draw the tongue and trachea towards you, and with the anterior surface of the trachea upwards put the thumb of the left hand behind and the forefinger of the same hand in front of the root of the right lung, and with the tissues at the bifurcation of the trachea thus protected sever the

root of the lung as near the lung as possible. Sever the left lung similarly by turning over the trachea, &c., and left lung, so that the posterior aspect of the trachea is uppermost; the procedure is then exactly the same as before.

Put one blade of the blunt scissors under the soft palate and cut through it and the uvula in the median line; put the tongue, &c., under the tap and remove any mucus from the surface with a sponge.

**Tongue, tonsils, &c.** Examine the tongue, make a careful inspection of its upper and lower surfaces. Holding the tongue towards the tip in the left hand between finger and thumb, the trachea falling over the first finger, make successive transverse sections of the organ with the brain-knife at intervals of about a centimetre and examine the appearance of the cross-sections.

Examine the tonsils on each side, squeeze them to see if the crypts will discharge their contents, make one or more cuts parallel to the long axis of the pharynx into each and inspect the cut surface. Now notice the pharyngeal wall, the epiglottis, the glottis, and the neighbouring parts, e. g. the piriform fossæ in front of the epiglotti and the arytæno-epiglottic folds.

**Œsophagus.** Insert a blade of the large blunt scissors into the upper end of the œsophagus and open it up by an incision along its posterior aspect; sponge its surface under the tap and examine carefully. Its mucous glands may be evident as small projections in the upper part or excoriation from post-mortem digestion in the lower.

**Larynx and trachea.** Insert a blade of the blunt

scissors in the glottis, cut through the posterior wall of the larynx between the two arytænoids and through the posterior part of the cricoid, when the trachea is reached, by cutting slightly to the right of the middle line the rest of the œsophagus may be preserved. When the point of the scissors reaches the bifurcation, it is pushed through the right bronchus, which is completely opened up by continuing the incision. The two halves of the larynx are then forcibly pulled apart and its interior washed or sponged out and examined; pay special attention to the vocal folds and the mucous membrane over the arytænoid cartilages. Do not be misled in thinking that a small opacity between the middle and posterior third of the vocal fold is abnormal. Inspect the inner aspect of the trachea. The lower part is almost always reddened in post-mortems, partly from stasis and partly from a terminal tracheitis.

**Thyreoid.** The glands of this region must now be examined; begin with the thyreoid. Identify the size of the thyreoid by sight and touch as it embraces the trachea; if anything unusual presents itself either of size or shape, the organ must be freed completely from the muscle and fascia that cover it and its exterior examined. Lay the cervical organs on the table so that the anterior aspect is facing you and the tongue lies to the left, then hold up the organs by grasping the larynx end with the thumb and forefinger of the left hand, the forefinger lying in the trachea just underneath the left lobe of the thyreoid; using the trachea as a guard, make a longitudinal incision into the lateral lobe of the thyreoid. By reversing the tongue end and inserting the left forefinger from

below upwards through the bifurcation, the opposite thyreoid lobe may be cut through in a similar way. The cut surfaces should be freed of any blood or secretion by gentle scraping and carefully examined. The middle lobe may be incised in one or two places as it crosses the front of the trachea, the larynx being held between the finger and thumb of the left hand, the anterior aspect of the thyreoid directed towards you. Incise now the lateral cervical glands on both sides, which should be done like the lateral lobe of the thyreoid, using the trachea as a guard to the forefinger. In most post-mortems they are so few and small as almost to escape attention, but in children there are usually one or two enlarged ones to be found, and frequently they are tuberculous. The submaxillary glands, which are generally removed with the tongue, attached on either side to its base, should be examined at this stage externally and by sections.

**Salivary and lymph glands.** In infants the thymus will be seen lying in front of the great vessels of the neck; take note of its general size and aspect, and make a few transverse sections into its substance. To examine the glands at the bifurcation of the trachea, from the dorsal aspect dissect the lower end of the œsophagus for a short distance from the underlying structures; this will expose the bifurcation and the gland which should be incised, with two or more parallel incisions in a frontal plane. Complete the examination of the glands by searching for any bronchial glands that may be present round either bronchus.

The upper pair of parathyreoid glands lie between the lateral lobe of the thyreoid and the œsophagus in

loose connective tissue. They are small elongated glands of a yellowish-brown colour, unlike lymphatic glands. These glands are not always easy to find.

**Aorta and large vessels.** It only remains now to open the aorta and the large vessels of the neck. Lay the organs with the anterior aspect uppermost, and slit up the aorta from the point where it has been severed above the diaphragm to the ascending portion of the arch where it emerges from the pericardium, slit up the main arterial trunks of the neck for a short distance and examine the whole surface thus displayed. The interior of the aorta should have a smooth yellow glistening surface ; examine also the thickness between finger and thumb, the suppleness to bending and crumpling, and the elasticity. It should also be held up and examined by transmitted light, to detect any loss of substance from scarring. On the under side of the arch, viewed from within, is a small area, seldom as large as a threepenny-bit, which strongly suggests a cicatrix to the untrained eye ; it is a normal structure, and represents the site of entry of the ductus arteriosus.[1] The veins of the neck need not be opened up unless a special examination is called for.

[1] The sectional area of the aorta is a function of the body surface and is expressed in the formula $\frac{W^{0.70}}{A} = K$ where W = the weight of the body, A the cross-sectional area, and K a constant (5·03 for man). Calculated in this way the area may be compared with that got by measuring the length of the slit when the aorta is pressed flat, with its inner surfaces touching, this being half the circumference.

**Heart** [Male, 280–340 grm.; female, 225–280 grm.]. Take up the heart, wash the surface under the tap, and examine the size, consistence, and the relations of the different parts. Note the general outline, whether it is pear-shaped or broad transversely, whether the apex is formed of the left or the right ventricle, the size of the atria, and the general aspect of the large vessels, and whether they are enlarged.

**General.** Notice whether the substance of the heart is firm or collapses if laid on the table. A pear-shaped organ suggests hypertrophy of the left ventricle; transverse breadth suggests enlargement of the right side. The side that forms the apex is probably enlarged over the other. Examine the size of each ventricle and atrium.

**Pericardium.** Now examine carefully the visceral pericardium; the parietal pericardium remains attached to the cervical organs. If there has been gross pericardial disease the heart will not have been severed from its connexions to the large vessels of the neck. Notice if the surface is normally smooth and glistening. Examine carefully front and back, especially near the roots of the great vessels and near the atrio-ventricular groove on the posterior surface, where a roughening due to pericarditis is likely to show itself earliest. Wipe the surface and examine by reflected light. Notice if the membrane is transparent everywhere, if there are thickenings (milk spots) preventing the reddish cardiac muscle from being seen. Notice the condition of the blood-content and whether the amount of epicardial fat tends to form a complete envelope. Pass the finger down the anterior branch

of the left coronary to ascertain any thickenings such as thrombosis. Examine the interior of the aorta and pulmonary artery, glancing at the thickness of its cut wall.

**Aorta and pulmonary artery.** Remove any clot as far down as the semilunar valves and test their competence by allowing a trickle of water to fill up the cavity of the vessel above them. If without any support the water remains above the valves, these may be considered competent, though this test would probably not discover some of the milder degrees of incompetence detected clinically, due to a muscular failure just below the ring. The pulmonary valves are frequently incompetent.

**Dissection.** The heart may now be opened. Hold it in the left hand, thumb in front, fingers behind, with the apex pointing downwards, the anterior surface facing you; with a sharp scalpel or one of the larger knives make an incision into the left ventricle down the left border from the atrio-ventricular groove to the tip of the apex; twist the heart round in the fingers so that the apex is uppermost, and make a similar incision on the right border from the tip of the apex to the atrio-ventricular groove. Put the heart on the table with the apex pointing towards you, and with the long-bladed blunt scissors make an incision in the anterior wall of the right ventricle, from a point one and a half inches above the apical termination of the cut along the right border, upwards to the pulmonary orifice; towards the middle of the distance the cut should by a gradual inclination approach the interventricular septum; the remainder

should be made by inserting one blade through the pulmonary artery, turning the other blade well towards the left and making it in one piece; by doing this the section passes between the anterior and left posterior cusps of the valve. To open up the rest of the left ventricle and aortic opening, begin at the tip of the apex and cut carefully along the edge of the inter-ventricular septum; after about two-thirds of the way up the ventricular wall the cut should be carefully extended to a point just short of the root of the auricle. Now insert one blade of the scissors from the top of this incision through the aortic ring, and pressing the upper blade of the scissors well over towards the left side of the heart, if necessary holding the auricle out of the way with forceps, sever the remainder of the ventricular and aortic wall. This cut is designed to go between the left anterior and the posterior aortic cusp, but the left anterior cusp is frequently wounded. To avoid this, the cut can be made with the blades of the scissors pointing upwards, and the exact line of the section can be given by looking down the aorta towards the valve cusps. The left auricle is occasionally opened into, but with a little care this, too, can be avoided. To open up the right auricle, find the opening of the superior vena cava and incise the right border to the atrio-ventricular groove at the spot where the other incision touches it. To open the left atrium, connect one of the right with one of the left pulmonary venous openings, and from the left vein make an incision to the top of the atrio-ventricular groove, where the lateral ventricular incision touches it. The position of

the incisions for the opening up the heart will be made clear by referring to Figs. 10, 11, and 12.

Put each cavity in turn under the tap, and wash out

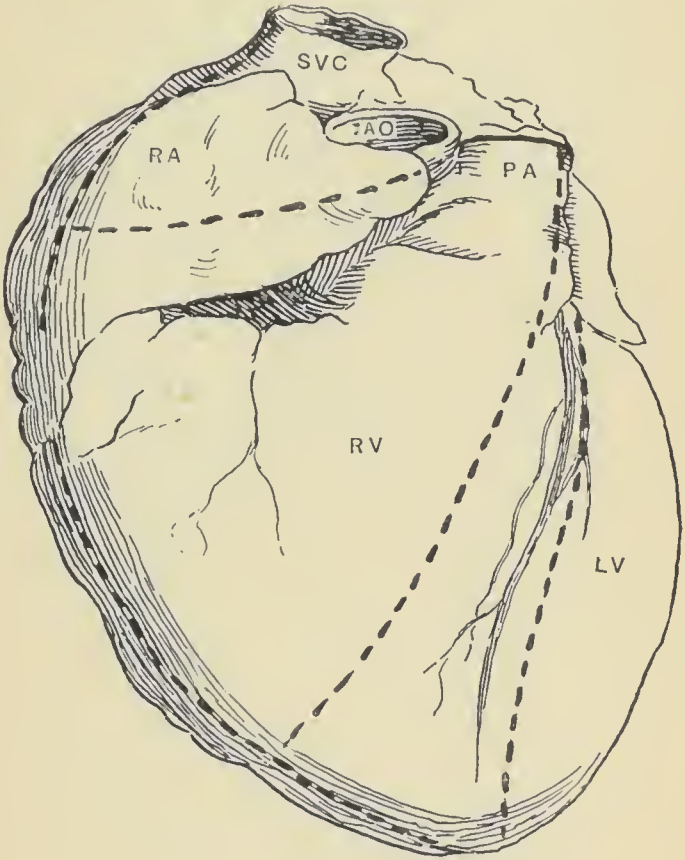


Fig. 10.

the blood and clots, making a note of the consistence and structure of these and any attachment of them to the walls of the cavity.

**Valve orifices.** Examine the valves : take up each cusp of the pulmonary and aortic valves in turn, and

notice any abnormal roughening of its surface, thickening, or attachment. The pulmonary valves are more delicate than the aortic, being subjected to less

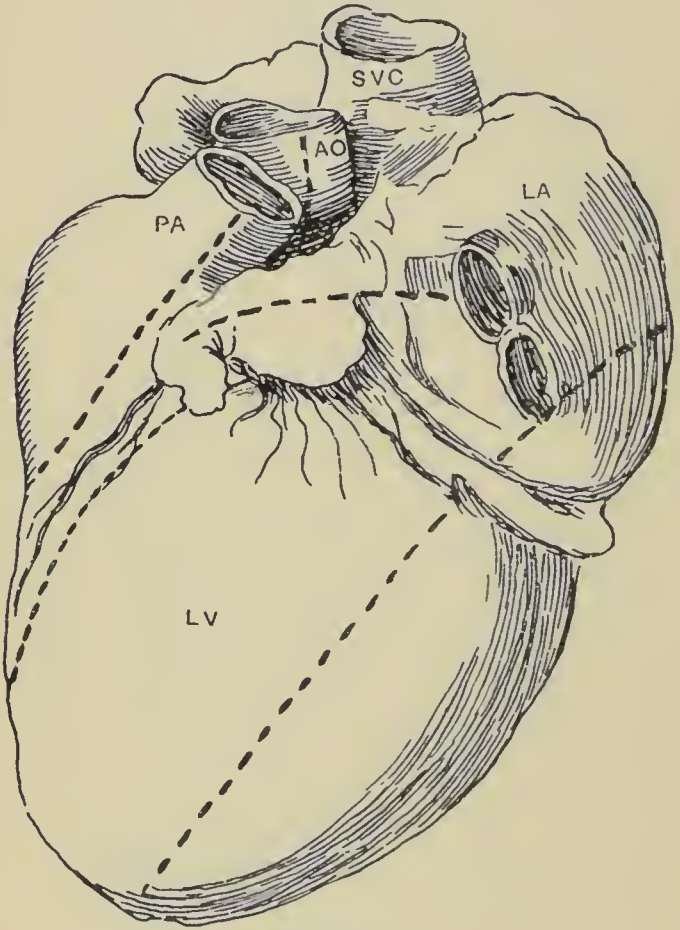


Fig. 11.

pressure, and have no corpora Arantii. The orifices of the coronary arteries will also be noticed. Test the number of fingers that can be inserted into the tricuspid and mitral orifices respectively: the former

normally admits three, the latter two ; but in the case of the tricuspid, muscular flabbiness causes an enlarge-

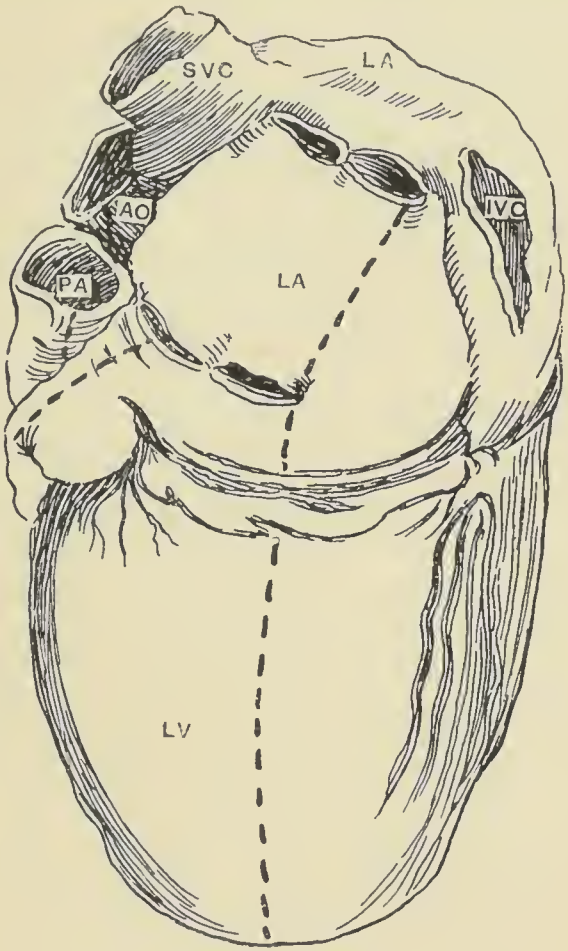


Fig. 12.

ment of the orifice. Look at the valves from their upper and under surfaces, and unless anything is present which makes it desirable to preserve the valve intact, the lateral incisions of the heart may be

completed by cutting on each side through the atrio-ventricular rings.

**Inspection: Valve surfaces.** The cavities may now be laid open and the surfaces of the valves displayed. Examine the surfaces minutely for roughening, fibrin formation or vegetations, especially at their edges and along the lines where their surfaces come together. Slight thickening of these valves, unless very marked, can only be determined by long practice; the valves naturally thicken with age, and they are thicker in manual labourers than in those who have led sedentary lives. The edges of the mitral valve are naturally thickened; this must not be mistaken for evidence of old endocarditis. Notice the thickness and length of the chordæ tendineæ and whether at their attachments to the papillary muscles there is an increase of fibrous tissue. Cut through the papillary muscles longitudinally in turn; excess of fibrous tissue will easily be recognized by the pearly bands which intersect the muscle. Palpate the valves by pressing the finger on them as they lie on the ventricular wall, the clotted blood behind them having first been removed. In this way thickenings or calcifications nearer the attachment will be detected.

**Interior of cavities.** Examine the interior of the cavities—right atrium, right ventricle, and left atrium. Notice in turn the size, the internal surface, the condition of the walls and, in the atria, the auricles. Of the right atrium notice specially the region of the superior vena cava and crista terminalis, the site of Tawara's node just in front of the opening of the coronary sinus and the foramen ovale, which is

often patent to a probe; but unless an actual gap in the curtain can be seen, complete efficiency must be supposed to have existed during life. Examine the muscular bundles for evidence of enlargement, flattening (which indicates dilatation), fatty degeneration, or other abnormality. If necessary, sections should be made into the muscle across the bundles to expose the cut surface.

Of the right ventricle, small degrees of enlargement of its cavity are more certainly ascertained from the general aspect of the whole heart; hypertrophy of its walls throws very much into relief the muscular bundles. Look specially on the endocardium of the conus arteriosus for evidence of miliary tuberculosis, if such is suspected.

Of the left ventricle, here dilatation will show itself most readily by a flattening of the columnæ carneæ and papillary muscles. Notice the presence of any thickenings of the endocardium; look at the undefended space and on the septum below it, the fan-like expansion of the left bundle of the conducting system of fibres (bundle of His). At the edges of this fan-like expansion, a greyish cord often passes to an opposite point of the ventricular wall, forming what might be termed a moderator band; its significance will now be rightly interpreted. It may here be stated that such bands exist in the right ventricle and much smaller ones in the right atrium, where they pass from bundle to bundle. Their grey colour, quite unlike the pearly opacity of fibrous tissue, makes them easy to recognize, and all doubt can be removed by examining the spot where they abut upon red muscle, where no

streaks of fibrous tissue stretching from the spot will be seen.

The thickness of the left ventricle in its thickest part is about $1\frac{1}{2}$ centimetres. Incisions should be made into the interventricular septum in the long axis of the heart, and the portion of the wall between the lateral and the septal incision into the ventricle should be split up; take it in the hollow of the left hand, with the apical end near the fingers, the outer side in the palm, and with the brain-knife make an incision through the middle of the wall parallel to the pericardium. Examination of all the cut muscular surfaces will expose any gross general change, and additional cuts may be made as necessity suggests.

Enlargement of the left atrium is easily detected, and if care has not been exercised in separating the heart from the other thoracic organs, a portion of the wall may have been completely excised. The inner aspect of the cavity is different from the other cavities owing to the dull yellowish-white, elastic and fibrous tissue which lies immediately beneath the endocardium. Notice the strands of this tissue, which radiate from the edges of the curtain covering over the foramen ovale. No opportunity should be lost of examining the thickness of the muscular tissue, for hypertrophy in small degrees can only be detected after long practice.

**Aorta, pulmonary, and coronary arteries.** Examine the pulmonary artery and the aorta, which has been seen in its lower portion in examining the mediastinal organs; note anything abnormal or peculiar. Open up both coronary arteries for at least two

centimetres or, if anything abnormal is suspected or found, for as great a length as possible. Use fine blunt-pointed scissors. The anterior branch of the left coronary artery will be found in the epicardial tissues at the top of the incision along the left of the septum of the ventricle, this should be followed down the anterior surface. The right coronary can be opened up either by entering it from the right anterior sinus of Valsalva, having first cut down to it through the aortic wall, or by cautiously cutting through the epicardial tissues parallel to the wall of the aorta over the spot where the coronary artery emerges, the vessel can be opened into and followed to its distribution. Notice the contents, the appearance and thickness of the walls, and the presence of much tortuosity which indicates sclerosis. The coronary sinus may be opened up from the right auricle at this stage, but is not usually necessary.

The final step is to weigh the heart. All clot and adherent tissue should be removed from the cavities and in connexion with the valves; the aorta and pulmonary artery should be cut off just above the semilunar valves (the other channels have been cut short already if the foregoing directions have been adhered to), and if more accuracy is needed the epicardial fat should be removed.

If it is desirable to preserve the heart, plugs of absorbent cotton-wool should be placed in each cavity, the cut surfaces brought together and stitched up again with a needle and fine string. Plugs of wool should be placed in the pulmonary artery and aorta and in each of the larger venous openings. The whole

heart may then be immersed in 10 per cent. formaldehyde.

**Left lung** [540 grm.]; **inspection.** Take the left lung in the hands, cleanse it, and make an inspection of its outer surface in the order—lateral convex surface and interlobar fissures, medial surface and root, apex and base. Palpate each surface as it is inspected. Notice the presence of local lesions, the colour, consistence, texture, and blood-content. The surface of the normal pleura is smooth and glistening, with little blood, showing the colour of the underlying lung. If there be a membrane on the surface, attempt to strip it off with forceps; if it comes away easily, leaving a surface smooth but reddened, then its formation has been recent, the membrane merely being a coagulum on the surface; if, however, it strips with difficulty and does not leave a clean surface, fibrous tissue has grown into the membrane. Further stages give rise to adhesions between opposed surfaces. According to the firmness of the adhesion, say between two lobes, so the age of it is judged; in old-standing cases it may be difficult to effect a separation without tearing the lung substance.

Most lungs met with in the post-mortem room are pigmented; the pigment on the surface tends to collect in the deeper layers of the pleura along the pleural edges of the septa of the lung lobules, making thus a network picked out with black. The posterior parts of both lower lobes are dark from excess of blood, which is accounted for by hypostasis owing to their dependent position. The apex of the lung needs special attention, because of the frequency of tuber-

culous lesions or their scars; it is seldom that a completely normal lung apex is seen in the post-mortem room. Careful palpation of the lung will quickly reveal any gross abnormality of texture; the normal lung gives the sensation of a fine crackle under the fingers or pressure between fingers and thumb; if the lung contains much fluid this is not present, and it has the feel of a sponge filled with water. Loss of the septa separating alveoli, making large air-spaces as in emphysema, gives the sensation of feeling a bag of feathers. Any completely solid portion of the lung, such as a patch of pneumonia or an infarct, is detected with great ease, and any spot thus found should be singled out for special examination during the next step of making incisions into the lung substance.

**Dissection.** Place the lung on its posterior surface with the apex pointing away, put the left hand flat upon it so as to steady it, and with the brain-knife make an incision through the length of the organ from the outer side to the hilum; other sections should be made, starting above and below this on the lateral side, converging towards the hilum, so that the segments into which the lung has been divided are like the leaves of a book. To make these sections well and neatly the knife must be sharp, and the blade should not be pressed straight in the direction of the cut but should be drawn gradually from heel to point along the line of the cut, and if, when the point is reached, the cut has not penetrated deep enough a second cut may be made in the same manner.

**Inspection of cut surfaces.** Expose the cut surfaces in turn, remove any excess of blood or secretion

by scraping the blade of the brain-knife lightly over it, and notice in general the presence of any local lesions, the colour, consistence, texture, and blood-content of the surface. Describe separately any portion which singles itself out from the rest of the substance of the organ or that has been detected during the previous examination, making a special section, if necessary, to expose it. Examine now each structure of the organ in the section in turn, pleura, cut bronchi and bronchioles, blood-vessels, parenchyma, and connective tissue of the septa. Any thickening, deposit, or growth would thus be detected in the pleura, the contents, size, and thickness of the walls of the air-tubes would be noted, and the state of the vessel walls and their contents. The parenchyma of the lung appears as an extremely fine network with minute depressions between; with a little practice any abnormality or irregularity in their size can easily be detected. It is the minute solid plugs of fibrin projecting from these cavities that gives the granular appearance to the cut surface of a pneumonic lung. The last step in examining the surface is to squeeze the deeper parts and to notice what exudes. In stasis and hyperæmia much blood exudes; clear fluid with minute bubbles comes from the parenchyma and bronchioles in œdema; pus or mucus, comes from the bronchi and bronchioles in inflammations of their walls.

It is often desirable to ascertain if a portion of the lung contains air or not; a small portion should be snipped out with scissors, freed from other parts whose consistence does not matter, and put into a bowl of cold water. If it sinks easily and quickly it is, of

course, airless, if it floats easily it contains air, and intermediate degrees of air-content cause it to sink or float slowly.

**Bronchi and blood-vessels.** Now dissect up the bronchi and blood-vessels from the hilum. Use small blunt-pointed scissors, and open up artery, vein, and bronchus, in that order, as far down as possible (when the right lung is dissected it will be necessary to do it in the order vein, artery, bronchus, as this is their relation from before backwards). Notice the content and surface and structure of each tube. Cast-like clots are often found in the vessels; if post-mortem they can easily be stripped from the walls, leaving no mark or part of their substance. The bronchi and the vessels should be traced to any cavity or area with which it may be desirable to ascertain their connexion.

The last step is to examine and cut into any gland at the hilum, or along the course of the bronchus which has been opened up. The lung is so seldom free from excess of blood and lymph that the determination of its weight is of slight value.

**Right lung** [650 grm.]. The right lung should be examined in a similar way to the left. The presence of a third lobe with its pleural surfaces and their relations will be remembered. In making the sections with the lung substance the posterior surface should lie uppermost, the apex pointing away.

## Examination of the Abdominal Organs.

**Spleen** [140–200 grm.]. Take the organ in the hand, cleanse it under the tap, and examine its size, colour, shape, and consistence. The normal spleen is

firm, dark red on removal from the body, but becomes lighter as its hæmoglobin is oxidized, having a smooth capsule with very slightly depressed points where the trabeculæ join the capsule.

Inspect the capsule for evidence of any inflammatory or other process and the hilum with its vessels. Place it on the table with the hilum down and its poles pointing to the left and right hands; now make two or three longitudinal incisions nearly complete by cutting with the brain-knife towards the table, the thumb and fingers of the left hand being made into an arch over the knife, so as to steady the organ on each side of the line of the cut. Inspect the cut surfaces at once, before oxidation occurs. Three things have to be examined—the pulp with the Malpighian bodies, the trabeculæ with the capsule, and the vessels. Normally the pulp is firm, showing whitish Malpighian bodies here and there, with whitish streaks indicating the trabeculæ between. In acute febrile diseases the pulp is semi-solid, and can be expressed from the interstices of the trabeculæ like water from a sponge.

**Liver** [1250–1700 grm.]. The liver, with the tissues and organs attached to it, must now be examined. Place the organs on the table as nearly as may be in their proper relation with their anterior surfaces upwards and upper surface of the liver towards you. Re-examine the relations of the organs in turn, and make special observations on any diseased parts, with dissection if necessary. Make an incision into the right border of the second part of the duodenum opposite the opening of the bile papilla, then squeeze the gall-bladder, and if bile appears from the opening, the bile-ducts are

proved to be patent. Examine the liver externally, notice its size, shape, surfaces, and edges. Open the gall-bladder and examine its contents; wash away the bile. If the subject is jaundiced the bile-ducts should be opened up from the duodenum at this stage, after opening up stomach and duodenum, but before making incisions into the liver; the method is described later. If any special condition of the liver exists, such as an abscess or cyst, this should be incised in the way most convenient for exposing its contents; if there is no local disease the liver should be incised with the brain-knife by parallel incisions in the long axis of the body two or three centimetres apart, beginning on the right side. One aspect of each section at least should then be exposed in turn, freed from blood by careful scraping with the knife or by washing with water. Notice the condition of the surface as regards the presence of local disease, colour, and texture of surface, consistency, and blood-content.

Much may be learnt from a minute inspection of the liver section, and indeed of any organ. The cross-section of the fibrous capsule can be identified in all except the smallest by the presence of the three vessels—artery, bile-duct, and portal vein. The smaller sections in a normal liver appear as whitish threads of connective tissue. The hepatic veins are distinguishable as patent openings with a transparent, or only slightly opaque, lining through which can be seen, in the smaller ones, the polygonal pattern of the hepatic lobules, each one opening by a minute pore in its centre—the intralobular vein. Almost without exception, the livers seen in the post-mortem room have some

fatty infiltration and evidence of chronic stasis, both probably the result of the failure of the circulation preceding death. A normal liver therefore is rare. But by the fatty infiltration which is found in the periphery of the lobules, the size and outline of the lobules can be determined; also the collapse of the hepatic venule and its tributaries, when the blood-pressure falls at death, makes a slight depression in the centre of each lobule, which can easily be seen if the surface be viewed by reflected light.

Alterations in the amount of connective tissue of the liver may be determined in three ways—(1) by the resistance experienced in pushing the finger or thumb into the liver-substance from one of the cut surfaces, (2) by comparing with the normal the amount of fibrous tissue in relation with the smaller fibrous capsules and the number of the smaller sections of this that are visible, (3) by the transparency or otherwise of the liver capsule; normally it is quite smooth, and almost as transparent as glass; it may be thickened generally, rendered opaque, or the thickening may take place along the edges of some of the larger septa as they approach the surface. This appearance is frequent on the under surface of the left lobe, where it can hardly be considered abnormal.

If the liver is to be weighed, it may be dissected from the other organs, but not before following up the bile-ducts and blood-channels, a dissection which is not always necessary.

**Stomach and Deodenum.** To open the stomach and duodenum turn the organs so that the upper surface of the liver faces away from you, the anterior surface

still being uppermost. Identify the œsophageal opening, insert one blade of the large blunt-pointed scissors into it, and cut round the greater curvature of the stomach as far as the pylorus, which should be cut through anteriorly. Continue the incision around the convexity of the duodenal curve. The ligature on the beginning of the jejunum will have to be cut through to complete the opening of the tube. With a stream of water, using a sponge when necessary, cleanse the whole internal mucous surface and examine it. The contents rarely possess any significance, except in medico-legal cases of suspected poisoning, when they should be preserved under seal for analysis. The mucous membrane in its normal state is a yellowish-grey membrane, not quite smooth owing to the minute openings of the gastric glands, and thrown into folds from the contraction of the muscular coats; it is seldom, however, that the membrane is seen in this state: more often it has a greenish tinge and is covered with thick tenacious mucus. The cardiac end usually shows some hypostasis, which with the changes undergone after death make it appear like an area of submucous hæmorrhages. In cases of suspected ulcer the most minute examination will be necessary.

The examination of the duodenum should be done in a similar manner; much of its internal surface will be bile-stained. Identify the bile papilla and open the bile-ducts if disease is suspected.

**Pancreas** [85 grm.]. Turn the organs with their anterior surface on the table, and identify the pancreas by touch. Make two or three sections into its substance with the brain-knife from the head to the tail.

Normally, the consistence of the pancreas is very firm, and on section the organ is divided up into pale polygonal areas half a centimetre across, each separated from its neighbour by loose connective tissue. The pancreatic duct can be found and opened up by inserting a fine probe through the bile papilla in the direction of the gland. Having found the duct, it can be opened by cutting towards the posterior surface of the gland.

**Aorta, Mesentery, &c.** The abdominal aorta is also attached to the posterior aspect of this mass of organs; it should be opened up and examined in the same way as the horacic portion, with which it should be compared. The branches of the cœliac artery, if they require to be opened, should be approached from the anterior aspect. This should be done before the pancreas is cut into.

There remains now to examine the mesentery, and the structures in relation to it, and the inferior vena cava. Expose the mesentery and display it, notice its thickness, surfaces, and content between the peritoneal layers; incise any glands that are enlarged; open up the superior mesenteric, portal and splenic veins, and note their contents, walls, and internal surfaces. The portal vein may be followed into the great transverse fissure of the liver. The inferior vena cava, which lies in contact with the aorta, should be slit up and examined.

**The Intestines.** The whole mass should be placed in a sink, and the ligatures at either end removed. If any portion would be better preserved without disturbing its contents, such as a tumour or an ulcer, it should be tied at each end and excised with a length of intestine on each side.

Take up the upper end of the jejunum and pull it

over the end of a tap, from which a gentle stream of water should be made to flow ; the water will force its way along the intestine, pushing the contents before it. The coils of intestine are apt to get kinked and stop the stream, but this should be prevented by undoing such kinks as they occur. The washing should be continued until a stream of clear water issues from the end of the pelvic colon, having carried all the contents before it. Take notice of and preserve anything unusual in the content of the bowel. With the intestines still full of water, slit them up along the whole length along the mesenteric border. This should be done with large blunt-pointed scissors or bowel-scissors. Impale the upper end of the gut on one blade, and draw successive lengths of the intestine on to the blade ; this, without any cutting motion of the blades, is sufficient to sever the thin walls of the small intestine. The rapidity with which this can be done will be facilitated by the care that has been expended in removing the bowel as near to the mesentery as possible, so that loops are avoided. Retain any portion of the bowel contents that calls for a special examination, such as parasites or blood-clot.

The large intestine is slit up in a similar manner, except that a little more cutting action is required. In case the bowel or part of it has to be removed in a piece with other organs, it will be necessary to open it *in situ*, without perfusing it with water.

Now make a complete examination of the internal aspect of the whole bowel from top to bottom. Let a stream of water cleanse it as it rests on the forefingers of the two hands pointing inwards, and by rotating one

finger successively over the other away from you, successive lengths of bowel are brought into view and can be examined. Any local lesion should receive special attention, and should be accurately described. Examine in turn the colour, the state of the surface, any secretion or other substance that remains attached, and the thickness, which can be done best by the sense of touch verified by the appearance of the cross-section. Moreover, the peritoneal surface should be examined at these spots. When the cæcum is reached, the opening of the vermiform process should be sought and with small scissors its lumen slit up and its surface examined in the same way as the bowel. Attached to the transverse colon is the large omentum; it should be spread out, inspected, and, if thick enough, incised.

The student should make a careful scrutiny of the regions of the bowel, so as to familiarize himself with their appearances; he should renew his anatomical knowledge of the surface of each subdivision; the aggregated lymph nodules often cause difficulty in their superficial resemblance to ulcers, and the solitary follicles might be mistaken for tubercles. He should also practise distinguishing the large from the small bowel by the presence in the former of the three longitudinal muscular bands.

## Renal and Pelvic Organs.

Lay the organs with anterior surface pointing upwards and the kidney pointing towards you, each organ having its natural relation to the others. Make a general inspection of the aspect of the organs as they

lie, and describe any obvious condition affecting one or more organs.

**Left Kidney and Suprarenal** [140–200 grm.]. Examine the anterior and posterior surfaces of the kidney, which should be covered by part of the fatty capsule. Feel its consistency, and that of the suprarenal gland, which should be attached to its upper pole. Inspect the artery and vein for any evidence of gross change. Hold the kidney about its middle with the suprarenal gland at its upper pole projecting well above the fingers, and make successive transverse sections through this at intervals of something less than a centimetre. Notice the amount and relations of the medulla and cortex, whether the cortex is much convoluted, and the layers into which it is subdivided, which usually are an outer fatty and an inner pigmented layer. Notice the colour of the medulla, and the relation of all parts of the gland to the blood-content. Grasp the tissues at the hilum of the kidney between the thumb and fingers of the left hand, holding the upper pole of the kidney uppermost, and with the brain-knife make an incision in the long axis of the organ so as almost to divide it into two symmetrical halves. By continuing the cut through the upper poles the two halves of the kidney can be turned back, exposing the pelvis and calices. Examine now in turn the substance of the kidney and the pelvis. As regards the kidney-substance, pay attention to its general outline, inner and outer, the amount of cortical substance, the presence of any gross lesions, and the general appearance of the cross-sections over the cortex, the boundary zone and the medulla. In the cortex examine the

outer edge which in swelling of its substance is everted, the colour of the cortical substance, its consistency, blood-content, and by reflected light the lines of the renal corpuscles which are normally straight. In the boundary zone notice any deviations in the leashes of vessels and tubules, and notice the thickness of the arteries which are cut across.

Of the medulla, notice the lines of collecting tubules converging to the papillæ, and any deviation from a regular arrangement. The capsule should now be stripped. The pericapsular tissues which normally consist of a moderate layer of fat, have probably been stripped off, and any further examination of them necessary should be made at this stage. Note the outer surface of the kidney before stripping the capsule. Take up the edge of the capsule with forceps at the middle part of the convexity, detach it slightly, and insinuate the thumb of the left hand underneath it. By exerting slight tension on the capsule, and assisting its separation with the thumb, the whole outer surface of that half of the kidney can be laid bare. Large vessels which connect from capsule to kidney-substance should be severed. Take note of the ease or difficulty with which the capsule can be stripped, and whether any portion of the kidney-substance has been wounded in the process.

Adhesions between the capsule and cortex mean an increase of the connective tissue of the organ. Of the outer surface of the kidney, notice any departure from the general smooth convexity of the surface in the presence of any depressions, projections, or fissures. Small unevennesses are best detected by reflected light. Examine any large depressions, if present, separately.

Notice also the consistence and blood-content of the tissue.

The same should be done to the other half of the kidney. Further examination of the kidney-substance is made by incising each half transversely to its long axis at intervals of about a centimetre. This can be done by holding it between the fingers and thumb with its long axis vertical, and cutting transversely just above the thumb and first finger. The surfaces thus exposed should be examined in the same way as the other surfaces of the kidney were examined.

Now examine the pelvis and its constituent calices; its contents, which, if liquid, may have disappeared on opening the pelvis, should be examined. Slit up the more important of these latter so as to display their extent, and notice the size, the shape, the presence of any gross lesion, and the condition of the mucous membrane as regards smoothness, thickness, and blood-content.

Hold the open pelvis towards you and pull slightly on the ureter, which is attached to the pelvic organs. This will make a conical depression towards the lumen of the ureter from the interior of the pelvis. Insert one blade of the small blunt-pointed scissors into this depression, and open up the ureter as far as the spot where it enters the bladder in the male, or where it dips into the tissues of the broad ligament in the female. Any enlargement, thickening, or abnormal content which has not been noticed in the general inspection will now be detected. Notice the smoothness of its surface, the thickness of its walls, and its blood-content along the whole of the course thus displayed.

The arteries and veins of the kidneys may be dissected up from the hilum if this is necessary.

The right suprarenal gland, kidney, and ureter should be dealt with in a similar manner.

**Male.** In the method of examination to be described it will be supposed that the organs have been completely removed and remain attached to one another; when the urethra has been severed just below the bladder the same directions will serve, omitting only the part dealing with the penis, opening the urethra at the base of the bladder instead of at the tip of the penis.

Lay the organs out with the anterior surface of the bladder upwards, and the tip of the penis pointing towards you: the testes, if still attached, should be placed below and outside the kidneys in the position as nearly as may be from which, in the embryo, they descended.

Inspect and feel the pelvic organs in turn, penis, bladder, prostate, rectum, and testes; note any gross abnormality in structure or relation. Insert the blade of the small blunt-pointed scissors into the urethral orifice and slit it up to the bladder, continuing the incision up the anterior median line of the bladder as far as its apex. Notice the condition of any contents, the presence of any gross lesion, and the colour, surface, and blood-supply of the mucous membrane of the urethra.

Make transverse sections across the urethra at any spot where the surface suggests further inspection to be necessary. The prostatic urethra should receive special attention; inspect the crista galli and the orifices of the deferent ducts and prostate glands.

Examine the shape, size, and consistency of the prostate, identifying the three lobes. Grasp the penis in the left hand, and let the back of the prostate rest on the second joint of the forefinger so as to put the prostatic urethra on the stretch ; in this position make several incisions into it transversely to the long axis of the urethra after noting if there are any gross lesions of its substance. Make an estimate of the relative amounts of glandular and muscular substance ; squeeze a portion to ascertain the amount and consistence of the secretion in its substance.

Inspect the inner aspect of the bladder in the routine manner for lesions, colour, surface, consistence, and blood-supply. Make a special inspection of the trigone and the orifices of the ureters, insert a blade of the small blunt scissors and slit them up as far as is necessary to connect with the incision from above, and complete the inspection of their lower portions. Examine the muscular coat of the bladder both at its cross-section and as regards the trabecular portion, through the mucous membrane ; glance also at the peritoneal coat. Turn the bladder over and, holding the prostatic urethra in the left hand, make transverse incisions from the neck of the bladder so as to cut into the vesiculæ seminales ; inspect the contents which flow out and the condition of the walls.

Take the left testis in the hand, and by touch observe the state of its substance. Identify by means of the ductus deferens which is the lower pole, grasp the tissues at the back of the organ with the fingers and thumb of the left hand, hold the lower pole uppermost and make with the brain-knife a median longitudinal incision into

the tunica vaginalis. The knife usually makes a small incision first; this can be completed by scissors. Any contents should be noted. Now evert the tunica vaginalis so as to expose the whole of its surface, and having identified the body and the epididymis observe any local lesions and the condition of the membrane. Hold the organ up as before, but with the parietal part of the tunica as well as the other tissues now between the fingers and thumb, and continue the median longitudinal incision as far as the mediastinum testis; turn back the two halves and inspect in the systematic way (lesions, colour, surface, consistency, and blood-content), notice the state of the tunica albuginea, the parenchyma and the amount of connective tissue stretching from the mediastinum testis. If this section has not properly displayed the structure of the epididymis, cross-sections may be made through it as it lies attached to the testis.

The ductus deferens should be felt and inspected from testis to prostate, and a few sections made through it, especially where, by inspection from without, an abnormality is suspected.

The right testis and ductus deferens must be examined in the same way.

Lay the organs, anterior surface downwards, on the table, and inspect the outer surface of the rectum by sight and touch: with large blunt scissors slit this up along its posterior aspect throughout its whole length. Wash out its contents, which should be noticed, sponge its surface, and inspect in turn any local lesion, the colour, surface, consistency, and blood-content. Any abnormal spot should be incised. Examine the muscular coat at the cross-sections.

**In the Female.** Describe any abnormality in the general relations and size of the pelvic organs not already commented on in the examination of the abdomen. Identify the bladder and the urethral orifice, and point the opening of the vagina towards you. Through the urethral opening put one blade of the large blunt scissors, and make a median longitudinal incision as far as the apex of the bladder. Evert its walls, noting the contents that escape. Examine the surface thus displayed for any gross local abnormality, the colour, smoothness, thickness, and blood-content of the mucous membrane, and any noticeable deviation from the trabecular arrangement of the inner muscular layers. Examine the orifices of the ureters and the entry of the urethra; slit up the former from the bladder to connect with that made from above. Hold the bladder in the left hand, the vagina pointing towards you. Slit up the side wall of this as far as the lateral fornix. The whole vagina attached to the uterus can now be everted; its inner surface and the surface of the os uteri examined. Notice whether the vaginal walls are smooth or rough, and the presence or absence of local lesions. Of the os uteri notice the presence of any secretion, irregularity of its lips, and state of mucous membrane. With scissors or the knife cut through the tissues at the base of the broad ligament so as completely to expose the anterior aspect of the uterus. Describe any obvious lesion, its shape, size, colour, and consistency to the touch in its different parts. Also describe any deviation from the normal of the external aspect of the uterine tube on either side.

Holding the organs by grasping the rectum with

fingers and thumb and turning the anterior surface towards you, make a median longitudinal incision into the uterus so as to open up the whole vertical length of the uterine canal, open up the lateral parts with blunt scissors so as to expose the whole of the cavity as far as the opening of the uterine tubes. Make an inspection of its internal surface, and note particularly the presence of any secretion, lesion, and the state of the sponged surface of the mucous membrane. Examine also the sections of the muscular coat. This done, the uterus should be held up by its lower parts to allow of making a few transverse sections of the first centimetre of the uterine tube where it is too narrow to be opened up. Notice the thickness and condition of the mucous surface of the muscular and peritoneal coats. The section will also have cut through, below the tube, some of the main lymph channels of the uterus, whose contents should be closely examined.

Examine the fimbriated end of the uterine tube, insert the fine blunt-pointed scissors and slit it open as far as possible, or, if the end of the tube is closed, open it by means of a longitudinal incision with the brain-knife.

Examine the secretion, any lesions present, the internal surface, thickness, and blood-content of the mucous membrane.

Take up the left ovary and make an inspection of its surface, noting at the same time the physical features of the whole gland. In women below the climacteric the surface shows irregular projections with a few scar-like depressions, and perhaps one or two corpora lutea which, if recent, will contain blood; in older women

the organ is shrivelled, and its surface is yellower and much fissured. Incise the organ longitudinally and examine its surface. Graafian follicles and corpora lutea will be seen in women of the child-bearing age ; fibrosis is evident in older women without these structures.

Take up the broad ligament in the finger and thumb, and feel it for any thickenings or solid parts such as glands ; inspect also the condition of the vessels and whether there is any accessory organ in connexion with the uterus or any of its appendages, such as a hydatid of Morgagni ; at the same time the round ligaments of the uterus can be inspected.

The final step is to lay the organs, anterior surface downwards, on the table, to inspect the outer aspect of the rectum, and with large blunt scissors to slit it up from below upwards. Wash and sponge over its surface, noticing anything unusual in the contents, the presence of any lesions, the surface, and consistency of the mucous membrane and its blood-content. Its muscular coat can be seen by looking at the cut edge.

# CHAPTER VI

## THE EXAMINATION OF THE BODY CAVITIES AFTER REMOVAL OF THE ORGANS, WITH THE EXAMINATION OF THE SENSE ORGANS

### Cranial Cavity.

Take up the vault of the skull, cleanse it if necessary with a sponge and inspect ; examine in turn its external and internal surface and the cross-section of the bones. Run the eye along the sutures and knock the convexity of the skull as one knocks a piece of crockery to detect a fracture.

Now turn the attention to the base of the skull, and examine in the order of the anatomical structures. First, after sponging out the cavity, take a general survey of the whole cavity for any deviation in the size, shape, and symmetry of the different parts. Next inspect the dura mater ; that portion covering the vault still remains attached posteriorly, and can be inspected on its inner aspect along with that of the base. Notice whether it is everywhere smooth, glistening, and pearly, whether there is any evidence of roughening or a ruptured fibrous attachment. Slit up the main venous sinuses, and examine the interior for contents and condition of internal surface. The superior sagittal sinus has already been opened ; the two transverse sinuses can be opened up by following them up from the confluens sinuum, the superior and

inferior petrosal sinuses can be opened up from where they enter into the jugular sinus. The cavernous sinus and its tributaries, the inferior sagittal sinus and straight sinus may need opening up : this is especially so in case the sinuses already opened up have contained anything abnormal.

The foramina, with their issuing nerves and vessels, should be inspected from before back—ethmoidal and optic foramina, sphenoidal fissure, the foramen lacerum with the carotid artery, the internal acoustic meatus, the jugular foramen, the anterior condyloid foramen, and the foramen magnum. The foramen rotundum, ovale, and spinous foramen will not be seen until the dura mater is stripped off the middle fossa.

The stalk of the hypophysis cerebri has been torn or cut in removing the brain ; identify this and the bony boundaries of the fossa hypophysis in which it lies. With the point of a scalpel and forceps carefully incise the dura mater as near the boundaries of its bed as possible, and severing any deep attachments as they are met, remove it bodily. It is well, in removing it, to hold the dura mater attached to it by the forceps ; rough treatment by holding the gland itself with forceps will destroy its shape. Some care should also be taken to remove the posterior lobe, which is of a paler tint and can thus be identified, without injury. Notice any changes in its physical features, make a median longitudinal section and examine the cut surface. In cases where hypophyseal disease or abnormality of the organs of internal secretion is suspected, the gland will be preserved for microscopic examination.

Finally examine the bones ; inspect the cut surface

which already has been noticed in the upper part, its thickness, and the state of its constituent layers, outer table, inner table and diploë. Strip the dura mater from the internal aspect at least for a small distance in each of the three large fossæ of the skull. This can easily be done by seizing the cut edges firmly with forceps and tearing it forcibly from the bone towards the middle of the base. Examine the bony surfaces thus displayed, the sutures, and for any evidence of fracture, whose detection can often be assisted by tapping the bone with the butt end of the scalpel.

## Sense Organs.

**Eye.** Directions have already been given, in the examination of the external features of the body, for an inspection of the accessible parts of the eye. In making a systematic examination of the whole sense organ the external parts should be again looked at, as much to keep in mind the conditions there present as to prevent any omission. Inspect in turn the external features of the lids and the boundaries of the orbit, the conjunctiva, the lacrimal apparatus, and the globes. Of external features notice any swelling, bulging, or loss of symmetry of the eyeballs; of the conjunctiva, which should be inspected completely by everting the lids, notice the presence of any secretion or local lesion, and the colour, consistency, surface, and blood-content of the membrane; the orifices of the lacrimal ducts and the lacrimal sac should be inspected, and the latter palpated with a blunt seeker; of the globes notice the condition of the cornea, contents of anterior chamber, iris, and pupil and lens.

We must now proceed to a dissection of the orbit from within the skull. With the corpse lying on its back, put a block under the head so that the skull cavity is directed slightly upwards. If the dura mater has not already been stripped off the anterior fossæ, this must be done and the surface thus exposed inspected. With a chisel and hammer cut through the roof of the chamber anteriorly along the attachment of the orbital to the vertical plate of the frontal bone, internally just lateral to the cribriform plate of the ethmoid, and laterally along the ridge separating the anterior from the middle fossa of the skull. The strokes of the hammer should be light, so as to do as little damage as possible to the orbital tissues. To open the optic foramen it will be found best to make two small saw-cuts in the direction of the canal, with their planes converging so as to meet at the canal ; after beginning the incision in this way the careful use of the chisel will completely expose the canal. The loose fragments of bone forming the orbital roof should be removed, and the boundaries made regular with small bone-forceps.

Inspect first the orbital periosteum which now forms its roof—it is normally a semi-transparent membrane. Incise this along the medial and lateral borders of the orbit and draw the flaps forwards. Next inspect the orbital fat, and in turn the different structures met with—lacrimal gland, muscles, nerves, arteries, veins, globe of the eye, and periosteum. Having cut through the supraorbital nerve and the levator palpebræ superioris muscle, draw aside the orbital tissues, expose the superior rectus muscle and cut it through.

The fascia bulbi may now be opened into, and the globe of the eye more fully exposed. Exert gentle traction by means of a blunt hook on the optic nerve and either cut through the globe with a sharp scalpel just behind the equator of the eyeball, or with scissors separate the muscles where they become attached to the eyeball and the conjunctiva round the cornea. In the former method the vitreous humour and probably the lens will escape ; these should be inspected at once. The difficulty in making a proper restoration of the external appearance is the chief bar to the removal of the whole of the globe ; nevertheless, this must frequently be done in eye cases.

The eyeball and the optic nerve should first be inspected from without. Make transverse sections across the nerve at two or three places, and examine the cut surfaces. With a very sharp knife make an incision across the eyeball at right angles to its axis just behind the equator ; the vitreous humour will tend to escape, and if the eye loses its rigidity so that incision with a scalpel is difficult, it should be continued with scissors. It is well to leave the anterior and posterior halves attached by a small bridge of sclera, so that the natural relations may be restored if necessary for reference.

Hold up the posterior half of the eyeball, and with forceps evert the edges of the sclera, so that finally its concave surface becomes convex ; a gentle stream of water directed on to the entry of the optic nerve will smooth out the retina on the convex surface. The retina can now be minutely examined with a lens ; notice the optic disk with its vessels, the macula lutea

and the fovea centralis, and the appearance of the retina in the peripheral parts. Raise up the loose retina from the chorioid beneath and inspect its surface.

The anterior part of the globe will have attached to it the greater part of the vitreous; this may be cut away with scissors bit by bit until the posterior aspect of the lens and the ciliary body is exposed, which should be carefully examined. The examination of the anterior chamber is best made by making a median incision through the length of the axis of the eye.

**Ear.** In cases where no serious disease in the bony parts of the ear is suspected, it will not be necessary to do more than examine the easily accessible parts of the ear and temporal bone *in situ*, but in cases dead of ear disease, or when there has been thrombosis of the transverse sinus or intra-cranial suppuration, it is necessary to make a complete examination and bodily to remove the temporal bone.

Inspect the pinna, the external acoustic meatus, and notice any abnormalities in its situations, conformation, as well as any wound, attached blood or secretion. Continue the end of the scalp incision vertically downwards behind the pinna for about two inches, and strip off the skin and superficial tissues anteriorly and posteriorly, cut through the external acoustic meatus and reflect the pinna as far as the root of the zygoma, posteriorly expose the whole of the mastoid process. The external acoustic meatus can now be inspected, freed from any blood exudation or wax, and the outer surface of the tympanic membrane seen. Look for reddening, perforation, or thickening of the membrane. This will be facilitated by chipping away

a portion of the bony meatus with small bone-forceps. Notice the condition of the tissues over the mastoid bone, whether œdematous, hyperæmic, or infiltrated with pus. Strip the bone bare over the mastoid process; inspect the periosteum to see if it is raised up by œdema; examine the bone and determine if it has become rarefied by inflammation. Look in the posterior triangle of the neck and beneath the sterno-mastoid for any enlarged glands.

Now examine the petrous bone carefully from the inside of the skull. Inspect first the internal surface of the dura mater, which should be grey, smooth, and glistening. Examine carefully for any roughening from fibrinous exudation or adhesions which have been torn through in removing the brain between the dura and the pia mater. Notice the condition of the internal acoustic meatus and the terminal portion of the transverse sinus, which should be opened up if it has not already been done before. Strip off the dura mater from the petrous bone by seizing the cut edge with forceps and pulling it inwards towards the apex of the bone; by this will be exposed the tegmen tympani, the tegmen antri, the semilunar ganglion, and the trigeminal nerve; the hiatus of the facial canal with the great superficial petrosal nerve issuing forth, and the internal acoustic meatus. Make a careful inspection of these parts to see if there is any discoloration, exudation, pus, or rarefaction of bone.

A few careful sharp blows on a chisel made rather oblique than at right angles to the surface of the bone over the tegmen tympani will open up the tympanum. Any abnormal contents such as exudation or pus will

at once be noticed, and whether there is any reddening on the inner walls or surface of the ossicles. Using the chisel and chipping away the bone roofing over the tympanum posteriorly, the attic of the tympanum, the tympanic antrum and mastoid cells can be exposed and their interiors examined.

For the removal of the whole temporal bone,[1] the side to be examined is placed uppermost by turning the head to one side. Put a small block under the head and make two saw-cuts, beginning on the cut edge of the skull about five to six centimetres apart, so as roughly to include the whole of the base of the petrous portion of the bone. The anterior cut is directed forwards and medially towards the sphenoid angle of the greater wing of the sphenoid, the posterior is directed also forward and medially towards the jugular foramen, skirting in its course the posterior border of the terminal portion of the transverse sinus.

A wedge-shaped portion of the base of the skull, including all the essential parts of the ear, as well as the lowest part of the transverse sinus, can now be removed by cutting through the remaining bony attachments of the petrous bone with the chisel and with scissors the soft parts which still hold it down.

To examine the acoustic apparatus the tympanic plate should be chipped away until a good view is obtained of the tympanic membrane, which should be carefully inspected for inflammation, perforation, or thickening. Make a reinspection of the interior of the

[1] If the temporo-mandibular joint has to be examined it must be done before the complete removal of the petrous bone.

tympanic cavity for abnormal contents, reddening of its lining or softening of bone ; test the mobility of the ossicles and pass a fine style or bristle forwards and inwards through the auditory tube, which should be patent ; inspect the anterior section where the style appears for evidence of pathological change. An opportunity is now afforded for a more complete examination of the tympanic antrum and cells, more bone being chipped away, if necessary ; also the connexion of any pathological change in the transverse sinus should be sought for between it and the mastoid. Examine also the internal acoustic meatus. The further examination of the ear and the labyrinth has to be done by means of saw-cuts through the bone. For ordinary work the bone-saw may be used, but for finer work—especially if the parts are to be preserved—the finest saw only should be used, such as a fret-saw. The first incision is made parallel to the long axis of the petrous bone through the middle of the tympanum, and in the line of the auditory tube. It is best, if the ordinary saw is to be used, to remove the incus from its connexions with the stapes and malleus, or at least to sever the joint between stapes and incus and draw this to one side. The bone will have to be fixed in a clamp, and the cut should be made from above downwards, so that the tympanum can be seen all the time, and as little damage as possible done to the tympanic membrane on the one hand and the inner wall of the tympanum on the other. This section allows a complete view of the tympanic membrane from the inside and of the foramen ovale, foramen rotundum, and the projection due to the facial canal. The cut

surface of the bone should be inspected for redness, discoloration, and softening. The second cut should be directed in the line of the internal acoustic meatus vertically downwards so as to pass through the centre of the spiral formed by the cochlea. Allow a gentle stream of water to play on the cut surfaces so as to free the cavities of the cochlea from bone-dust. Notice the contents of the bony cochlear canal. Other saw-cuts can be made, if necessary, parallel to either of these so as to expose the parts further.

**Nose.** For the examination of the nose and the sinuses accessory thereto, there are several methods, but the one in general use is known as Harke's method, and consists in making a frontal section through the bony parts of the base of the skull so that the two halves can be drawn apart and the interior of the nasal cavities completely inspected. No other method gives such a complete exposure without disturbing the natural relations of the parts.

A median longitudinal incision is first made from the middle of the posterior flap of the scalp formed by the bimastoid incision made in removing the brain to a point two or three inches below the occipital protuberance, and the skin and superficial tissues laid back. Next the anterior flap of the scalp is further drawn down, dissecting it from the frontal bone until the supra-orbital ridges are well exposed and the root of the nose is clearly seen. Put a large block under the neck, flex the head well forwards, and standing on the right side of the body the skull is sawn through in the frontal plane, cutting through the following structures in order—the squamous portion of the occipital, the basi-

occipital, the sphenoid with the clivus, the fossa hypophyseos, the ethmoid, and the frontal bone. In front of the foramen magnum the saw-cut should deviate lightly to the right or left, so as to avoid the middle plate of the ethmoid and nasal septum. The cut should terminate in front just where the frontal adjoins the nasal bones. It may be necessary, if the parts adhere too firmly, to sever the atlas posteriorly and anteriorly with saw or chisel, as well as to cut the connexions of the dens. The two halves of the skull can then be forcibly pulled or wrenched apart by the T-shaped chisel until a good view of the nasal chambers is obtained, which should then be inspected as to gross lesions, general conformation, condition of the mucous membrane, and the presence of any secretion. It will be necessary to remove the septum nasi to get a view of that side to which this still remains attached. The sinuses which have also been laid open should be examined in the same way, namely, the frontal sinuses and the sphenoidal sinuses. The ethmoid sinuses can also be exposed by cutting away the middle and upper conchæ by breaking through that part of the orbital plate of the frontal which roofs over certain of the cells.

Certain of the air sinuses can, however, be exposed and completely inspected without making the median frontal incision of the skull. With a sharp chisel the part of the frontal bone which roofs over the frontal sinuses on either side can easily be removed, and the interior of the cavities inspected ; similarly, by removing a portion of the body of the sphenoid just medial to the lesser wing, the sphenoidal sinuses can be explored. The ethmoidal sinuses can be got at from the orbit by

removing the orbital plate of the ethmoid. By removing the tissues of the orbit posterior to the eyeball and pulling the eyeball forwards the orbital plate of the maxillary bone can be seen and the maxillary sinus with little difficulty opened into.

**Neck.** Put the hand under the skin and make a digital examination of the parts in front of the cervical vertebræ up to the basi-occipital; notice the presence of any depression or projection from the bodies of the vertebræ. If the subject has died from an accident, move the head from side to side and backwards and forwards, so as to detect a fracture. Feel also anteriorly for the choanæ and run the finger round the maxilla and mandible. The soft parts of this region that yet remain can also be inspected to some extent in this way; but if it is necessary to examine the parotid or the lymph glands in front of or behind the sterno-mastoid, it is best to prolong vertically down the neck, on one or both sides, the incision made in reflecting the scalp. The anterior flap can be reflected forwards by cutting through the external acoustic meatus, if this has not already been done, and in this way the exterior of the parotid gland can be exposed. In this dissection also the temporo-mandibular joint can be fully exposed and opened.

**Thorax.** Inspect first the soft tissues that have been reflected. Evert the skin-flaps and notice the condition of the pectoral muscles; make one or two sections in the long axis of the body and notice the appearance of the cut surface. Notice also the condition of the subcutaneous fat. If the subject is a female this is the time to examine the mammary glands;

longitudinal incisions are made into it from the deep surface, being careful to avoid making a button-hole incision of the skin. Palpation of the gland from the exterior will enable any irregularities or tumours to be felt, which can then be incised from the deep surface, completely exposed, and examined.

Take up the triangular piece of the anterior thoracic wall with the sternum and rib cartilages and examine the anterior surface, the posterior surface with the remains of the pleura, the internal mammary artery, and vein; incise any enlarged gland that may be here. Notice the cut ends of the cartilages. Fractures of the sternum can be detected by attempting to bend the bone. Make longitudinal sections along one or two of the rib cartilages. Calcification can be detected by its stony hardness. Small whitish areas with a blood-vessel in the centre are usual in older persons.

Remove all blood, &c., with a sponge, and inspect the inner surface of the pleural cavity. Any irregularity of the pleural concavity, roughness, adhesion, or projection from a rib will be noticed. The vertebral column will have been stripped clean of any soft tissues, otherwise it is here that the thoracic duct should be sought for; there still remain, however, portions of the azygos veins, splanchnic nerves, and perhaps a lymphatic gland or two.

If there is likely to be any fractures of the clavicle, ribs, or vertebræ they should be sought for or verified. Move the clavicles forwards and backwards on their outer attachment and feel along their whole length; then holding each rib by its cut anterior end, move it quickly inwards and outwards, and pass one or two

fingers of the other hand gradually along the inner surface to the vertebral column; the site of fracture can thus easily be determined. In subjects which have died from physical violence it is necessary to do this for each rib on both sides. Old fractures show themselves as thickenings along the course of the ribs, with perhaps an old pleural adhesion at the site. Fractures of the vertebræ can be detected, either by passing the hand down the column with the thumb on one side and the fingers on the other side, when the irregularity may be perceived, or by rocking the vertebral column to and fro, grasping the vertebræ at different levels, when any fracture or dislocation will be detected by an excess of mobility in the portion moved. The red bone-marrow of the vertebral bodies can be inspected by incising the vertebral disks on either side and splitting off with a chisel the anterior half of one or two vertebral bodies.

Split one or two ribs longitudinally for a short distance with the heel end of a strong knife. This will give a view of the red marrow, which can be squeezed out if the rib be put into the jaws of the lion forceps. Either by stripping off the skin and superficial tissues further, or by using the bone-forceps from within the thoracic cavity, any portion of a rib can be quickly removed for further examination.

In suspected disease of the vertebræ, these should be carefully felt for any irregularity; then with the corner of the blade of a chisel or point of an old knife their bodies should be prodded to detect any softening. One or two vertebral disks should be cut into transversely. The posterior portions of the

vertebræ should be examined from behind, after the removal of the spinal medulla ; this will be described later. But if a very careful examination is necessary, as for instance, to detect a small focus of disease or for the complete examination of a fracture, that portion, with at least one sound vertebra at either end, should be separated above and below by transverse incisions through the intervertebral disks, and by chisel and knife bodily removed, for more accurate observation by longitudinal sections.

**Abdomen.** Examine in the order—peritoneum with the retro-peritoneal tissue and lymph glands, muscles, viscera (e. g. arteries, not removed), and bones (vertebræ and pelvis). Only small parts of the peritoneum remain attached to the abdominal wall, diaphragm, &c. The recti, psoas, and quadratus lumborum muscles should be incised longitudinally ; the diaphragm can be examined both through the transparent peritoneum or pleura, and by section in the direction of and across the fibres. If there be no gross lesions to attract attention, notice the size and colour of the fasciculi and the amount of interstitial tissue.

If the directions for removal of the contents of the abdomen have been carefully followed, little will remain except the walls of the abdominal cavity. Nevertheless, the bed of the viscera should be inspected for lymph glands, the terminal portions of the iliac arteries and veins should be slit up and, if necessary, followed downwards into the thigh by making a median longitudinal incision over the course of the vessel. This is the occasion also to examine the lumbar and pelvic nerves as they emerge from the vertebral canal.

Pass the fingers and thumb down the vertebræ and front of the sacrum, and notice any irregularity, swelling, or alteration of consistence. Grasp the column with the two hands some distance apart, and exert tension in opposite directions, to detect the presence of any fracture, which will be evident by any vigorous movement. Strike the bodies in turn with the corner of the chisel to determine if the bone is altered in hardness; incise one or two of the intervertebral disks. The complete examination of any lesion of the vertebral column can only be done by removal of the portion affected, with the vertebræ above and below.

Finally, examine the bony framework of the pelvis; pass the hand inside the pelvis, and feel the inner aspect of the bones carefully. Press downwards on the pubic arch to determine any undue mobility and, if such is present, carefully feel inside until the fracture or dislocation is discovered. The sacro-iliac joint should be inspected by dissecting away the muscle, and the symphysis pubis should be felt.

**Vertebral Canal.** This examination is best done immediately after the removal of the spinal medulla, before the body has been turned on its back again. Inspect first the row of laminæ and spines forming the roof that have been turned back, pass the finger along their inner aspects to detect any irregularity, and notice the condition of the interior of the bone at the cut ends. Then inspect the interior of the canal, anteriorly and laterally, from above downwards. The posterior common ligament of the spine is normally smooth and pearly grey, and any reddening or roughening of it should be further examined. Pass the finger down the

posterior aspects of the vertebral bodies for the detection of any irregularity or fracture that might not be evident to sight. The canals of exit of the spinal nerves can be inspected, and in case of fracture or joint disease, the articular processes should be examined. The articulation of the head of the rib to the vertebral body can be exposed at this stage.

In case of sudden or violent death, the odontoid processes of the axis must be examined for dislocation backwards or bony disease.

**Examination of the limbs.** The internal structures of the limbs require to be examined only when there is actual or suspected disease in these parts. In the external examination of the body obvious lesions will have been noticed and described; these should again receive careful and detailed examination from without, and any portion of the limb which it is proposed to expose by dissection should be first examined by sight and touch; in the case of joints, the amount and freedom of movement should be tested.

The diseases for which an examination of the limbs is necessary are fractures and dislocations, gross disease of bone or joint, such as osteomyelitis, tumour, osteo-arthritis, rheumatoid arthritis, gout, disease affecting nerves and muscles, blood disease such as pernicious anæmia and leukæmia, spinal disease which has affected the muscles, bones, or joints, and general disease such as pyæmia, in which lesions in the limb are suspected. It may also be necessary in new-born children to determine the age by the state of the ossific centres.

The incisions made should be in the long axis of the limb, not longer than is convenient for the complete

exposure or removal of the organ or lesion, and, when possible, should be made towards the posterior parts of the body rather than towards the anterior. Any incisions made during life should be utilized if possible. For the shoulder-joint no further incision will be necessary, for it can be exposed by flaying off the main skin-flap from the front of the chest until the joint is exposed.

It is not necessary to give directions for the examination of each structure separately, but it is perhaps well to indicate a method for the routine examination of joints and bones. In the examination of a joint, inspection of the parts from without will show the disposition of the constituent bones one to another, and whether there is any dislocation; movement of the limb will detect undue freedom or restriction at the joint. Any alteration in this direction had best also be examined after the joint is exposed by feeling the bone during the movement of the limb. The capsule of the joint should next be examined for evidence of gross lesion, thickening, or inflammatory œdema; this last would indicate inflammation within the joint, and if it were desirable a bacteriological culture might be made of the contents of the joint. On incising the capsule and letting out the contents, the amount and consistence of the fluid would be noticed. Inspect carefully the interior of the joint-cavity, both as to the synovial reflexions and those parts which have to bear friction. Notice whether the cartilage on the head of the bone is normal in thickness or whether it is worn grooved or eburnated; notice, too, the edges of the articular surfaces.

For complete inspection, bones are best removed

from the body. Notice first any alterations in the size or shape, and whether there are any gross lesions; inspect and feel both the shaft and extremities. Inspect the muscular and fibrous tissue that remains attached to the bone for evidence of an inflammatory process of the periosteum; cut down to the surface of the bone to detect any infiltration or thickening of the periosteum.

The bone should now be sawn through longitudinally so as to expose in cross-section the extremities, the ossific centre, and the medullary cavity. This can be done with an ordinary saw if the bone be held in a vice, but is most easily done with a circular band-saw worked by a foot-pedal. Special sections may have to be made to expose in the best manner the ossific centres in the case of young subjects.

# CHAPTER VII

## SPECIAL POST-MORTEMS

### 1. Bacteriological Post-mortems.

Before a complete elucidation can be made of the cause of death in any infective disease, the bacterial cause must be identified in the organs. In the case of certain infective diseases, such as scarlet fever or measles, this cannot at present be done; but every infective lesion that suggests that the active cause is still present should be examined for organisms, if not by culture, then at least by stained films or sections. The apparatus actually required at the examination is not elaborate, and may easily be transported if post-mortems have to be done in private houses or at a distance. The following are the necessary things—(1) a branding-iron (Fig. 13), which can be heated red-hot for searing the surface of the part or organ; (2) a Bunsen-burner or spirit-lamp, for heating the branding-iron and for sterilizing platinum needles; failing either of these, a good glowing fire may be used; (3) a sterilizer for making aseptic a few instruments such as a scalpel, a forceps, and a scissors; (4) a platinum needle and loop; (5) some incubation tubes; for

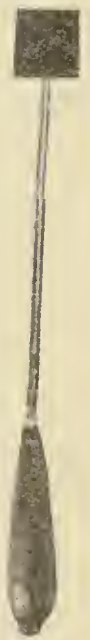

Fig. 13. $\frac{1}{6}$.

ordinary purposes sloped bouillon agar or plain bouillon is best, but for special purposes others will be needed — e. g. for the cultivation of the tubercle bacillus, glycerine potato, or Dorsett's egg medium ; for the gonococcus, ox serum agar ; for the vegetable parasites, malt agar ; but it is presumed that the student has a practical acquaintance with bacteriology, and for special investigation works on bacteriology must be consulted ; (6) several sterilized Pasteur pipettes and some rubber teats ; the pipettes are best kept unbroken by plugging with wool each end of a straight piece of glass tubing about 6–7 inches long, wrapping each up in paper and sterilizing by dry heat. When a pipette is required, the tubing is heated in the centre and two pipettes are made by drawing out the centre part. A somewhat more convenient pipette for post-mortem work is made by drawing out the tube in the flame again just above the shoulder of the pipette, so as to make a small spindle-shaped bulb between the capillary end and the larger part ; this, by sealing-off the tube above and below the bulb, enables a larger amount of fluid to be safely carried ; (7) several small packets of glass slides freed from all grease by hydrochloric acid, acid alcohol, and put up in paper packets of half a dozen each.

Whether the identification of the organism is to be made by cultures or not, several smears on glass slides should be made of the suspected material. This will enable the predominant organism to be detected, and will prevent any error from the more vigorous growth on culture media of a contamination ; for even though perfect asepsis has been maintained in obtaining the

culture, organisms foreign to the disease may have entered the organ from the bowel, by way of the blood-vessels after death, and it is not always necessary to endeavour to obtain the organism by culture, for, e.g. in a tuberculous abscess, the organism can be identified in the smear alone. In the case of an abscess in a solid organ, the procedure is to sear an area on the outside, to cut into it from this area with a sterile knife and to take up some of the pus in a pipette or loop for inoculation of the culture media and afterwards for making films; a second pipette may also be used and the contents, after being sealed up, further examined at leisure, if necessary. In the case of a solid organ, such as an inflamed lung or kidney, the same procedure is adopted, only that the tissue fluid that exudes on section with the sterile knife is used, or even a small portion of the organ cut out by sterile scissors; smears may always be obtained by rubbing a portion of the organ over a clean slide. The procedure is not always so straightforward if cultures have to be made from one of the body cavities, such as the pleural, peritoneal or pericardial, or from the meninges, interior of the ventricle, or bladder; but in any case the principles of asepsis are the guiding rules. It may be, for instance, that the presence of infective material has been unsuspected before the cavity has been opened up in the usual way. In this case it will be necessary to look around for a pocket of the cavity which has not discharged its contents. In the case of any of these cavities not previously opened up, it is necessary to sear an area at the site where the cavity is to be opened, and cautiously to open it with a sterile scalpel or

scissors and to remove a specimen of the contents with a pipette; this is the way also to make a culture of the heart's blood in septicæmia or malignant endocarditis. Portions of an organ that have already been exposed may sometimes be utilized by washing them first thoroughly in water or saline, then for a few seconds in absolute alcohol, and finally in sterile saline solution; the tissue can then be incubated in broth.

When the organism has to be obtained from infections of the lungs or the alimentary tract, the relations of these parts to the exterior, owing to natural contamination, may prevent the easy or certain isolation of the organism. In the case of a lung infection, cultures made from the cut surface of an inflamed bronchial gland might be successful, whereas cultures from the lung surface might be contaminated; again, in the case of infections of the bowel, such as typhoid fever, the gall-bladder or the spleen would give better hopes of a pure culture than the surface of an intestinal ulcer.

Material from syphilitic lesions should be put into 10 per cent. formaldehyde in very thin pieces and taken through the procedure of Levaditi's method for the staining of spirochætes. Finally, in any case of obscure infective disease, the student should let slip no opportunity of attempting to find the cause.

## 2. Animal Parasites.

The larger internal parasites—such as tapeworms, round-worms, and even thread-worms—will not escape observation if the routine methods hitherto detailed are carried out. This, however, is not so in the case

of anchylostomiasis or uncinariasis in which a very careful inspection of the duodenal mucous membrane may be necessary.

The difficulties are much greater in such diseases as malaria, filariasis, trypanosomiasis, and kala-azar, in which the parasites are microscopic ; and these diseases are more likely to be missed, on account of their rarity, in most general hospitals. The identification of these conditions rests on the discovery of the parasite in the various organs and fluids which each species inhabits, and the method is to make numerous films and dry them quickly in air for staining by one of the varieties of the Romanowsky method. The tissues specially concerned are the blood, spleen, liver, lymph glands, and cerebro-spinal fluid.

### 3. Medico-Legal Cases.

In the case of all deaths which involve legal proceedings, a post-mortem examination should not be done until an order has been received from the coroner authorizing its performance ; and it is necessary in doing it to have constantly in mind the kind of evidence that will be required. If the person has died as the result of an accident, then it is merely necessary to determine those facts immediate and contributory that have caused death ; if, on the other hand, there is a suspicion of homicide, then the most careful and searching inquiry may be necessary to determine the exact circumstances attending the death of the person ; in this case the procedure will only be described in outline ; for fuller details medico-legal works must be consulted.

It is imperative that the records are most minutely

taken at the time of the examination, by dictation if possible. No antiseptics should be allowed to come into contact with any of the organs, some of which may have to be preserved; several wide-mouthed chemically clean bottles will be required for this purpose. The organs are best preserved by keeping them in an ice-chest or cold chamber.

If the body remains in the place where death occurred, all the circumstances of the surroundings must be carefully and accurately enumerated. The attitude, facial expression, clothing, and general development, and state of the body should be noted in order. Coming to the usual external examination of the body, the most searching inquiry is often required, especially in criminal cases, and it should be done according to the directions laid down on pp. 25–31. No feature, however minute, is too insignificant for a note; a careful search should be made for the slightest evidence of bruising, wounds, fractures, or violence of any kind. Wounds should be described as to their exact situation, length of aperture, direction of incision, the structures injured, and the condition of the superficial and deep tissues forming the boundaries. Wounds may have been inflicted before or after death, and in the former case may be old or recent. Those inflicted after death have their edges in contact, show little or no hæmorrhage and no clots, and there are no signs of inflammation or effusion in the surrounding tissues; those inflicted before death gape, have everted edges, there is evidence of hæmorrhage, either in the wound or neighbouring tissues, and of clotting in the larger vessels. The length of time that a wound has existed before death

can roughly be guessed by the tissue-changes present on the raw surface and in the area surrounding; in an aseptic wound the reaction will be chiefly that of repair without much inflammatory reaction, whereas in a septic wound there may be necrosis and sloughing if the bacterial poisons are still active, or an excess of granulation and cicatrization if the wound is mainly in repair. It is specially necessary in medico-legal cases to make a thorough examination of all the orifices of the body.

In cases of suspected poisoning, the odour of the corpse or the colour of the blood-pigment in the skin may be peculiar. The mouth and lips may give evidence of corrosive action; all viscera should be preserved and in addition some blood for evidence of abnormal pigments, a portion of bone, and the contents of the hollow viscera. The solid organs should be placed in clean jars with a wide mouth and the lids securely tied down, sealed, and placed under lock and key. The contents of the stomach, intestines, and bladder should be preserved in three separate jars. In removing the thoracic organs it will prevent any leakage of the stomach contents if the œsophagus be severed between two ligatures.

**Criminal abortion** is produced either by the attempt to insert instruments into the uterus or by the aid of certain drugs. The former method in unskilled hands often produces laceration of the posterior fornix of the vagina or perforation into the abdominal cavity; this site, therefore, should receive a very careful inspection both from the peritoneal and vaginal surface. The drugs used to produce abortion act either directly upon

the uterine muscle—such as ergot, quinine, and probably lead—or indirectly as a consequence of a drastic purge, or by irritation of the kidney and urinary tract—such as cantharides. If such be suspected, the case becomes one of poisoning, and the procedure should be as already described, but attention should be directed to the gums for evidence of lead-poisoning, to the stomach and intestines for evidence of an irritant purge, and to the kidneys and bladder for evidence of a poison secreted by the kidneys.

In **Drowning**, the hands may bear evidence of having clutched something in the death-throes, such as the weedy bottom of a lake, or they may show abrasions. The mouth, pharynx, and trachea may be filled with frothy mucus.

In **Criminal assault**, evidence of bruising or abrasion of the hands and wrists, and the presence of stains, blood, or secretions on or around the genital organs is important. The accessible genital organs should receive a very thorough examination for the presence of any bruising or laceration, especially of the hymen. The presence or absence of menstruation should be determined, and whether the parts suggest habitual coitus. The anus should also be examined. Before disturbing the contents of the vagina a small amount should be drawn up into a clean sterile Pasteur's pipette and the capillary end sealed in the flame. The secretion can then be examined for spermatozoa or for bacteria—(1) diluted in saline, (2) stained as a wet film by mixing with some very dilute carbol-fuchsin, and (3) according to various bacterial methods of staining dried films.

In the examination of **New-born children**, note

any marks which might serve for purposes of identification ; attention should be paid to the general evidence of maturity, the conformation of the body, the features, and the length of the nails. Notice the surface of the skin whether it shows traces of the vernix caseosa, scaliness, or whether it has a fine downy hair upon it. The height and weight of the body should be ascertained. A caput succedaneum should not be mistaken for evidence of violence, and the orifices should be inspected for malformations, secretions, or foreign bodies. The neck may show evidence of strangulation. The state of the umbilicus and any attached portion of cord should receive attention, and in opening the body the incision over the abdomen should be slightly to the left, so as not to injure the umbilicus and the structures which lie in the falciform ligament and below in relation to the urachus. Before opening the thorax, ascertain the height of the diaphragm which lies opposite the fourth rib in mature unborn children, but opposite the fifth or sixth rib in those that have inspired. When the thoracic and abdominal organs are fully exposed, the lungs and heart should be carefully examined *in situ* ; if inspiration has occurred the lungs have a larger volume and their surface is 'marbled', but if inspiration has not taken place they are darkish organs placed far back in the pleural cavities. Open the pericardium and the right ventricle by the usual incisions and determine whether the ductus arteriosus is patent, and if not, whether it is filled with clot or organized tissue. In the abdomen the condition and contents of the ductus venosus and the two umbilical arteries should be ascertained and the state of the

trachea. On removing the thoracic organs from the body the whole mass should be put into a vessel of water to observe whether they sink or swim; further, each lung and each lobe separately should be tried and small portions of each lung. Portions of all lobes of each lung should be wrapped in cloth and all air possible expressed by the operator standing upon them. It is not possible to express all the air from a naturally-inflated lung so that it floats even after this treatment; but it is necessary to state that in weakly infants or in those that have only been born a short time, portions of lung will be found which sink after having their air expressed in this way. It will then be possible to form some opinion whether the lungs have been fully or partially expanded. Finally, it is necessary to determine whether the child was viable and if so whether it was mature. This is done by examining the condition of certain epiphyses. In a child which is viable there is in the calcaneus an ossific centre about the size of a pea, and in a mature child there is an ossific centre of 5 mm. diameter in the lower end of the femur, another in the upper end of the tibia, and a third centre in the cuboid bone of the tarsus.

In **Accident cases** it is necessary to ascertain three things: (1) what is the complete account of the injury done? (2) what is the injury that has caused death? and (3) is there any evidence of a cause contributory to the accident? The external examination of the body, the bones, and joints should therefore receive attention, as well as a careful examination of all the internal organs. The cause of death in such cases may be hæmorrhage, shock, cerebral injury, sepsis

from a wound, &c. Amongst the causes contributory to the accident are frequently those which produce unconsciousness, faintness, giddiness, or lack of control; therefore the brain should be examined for evidence of tumour, hæmorrhage, thrombosis, or marked arteriosclerosis. The heart should be examined for evidence of myocardial, coronary, or aortic disease. The kidneys should be inspected to determine if the patient suffered from uræmia, and the urine in the bladder should be tested for albumin and for sugar; lastly, the stomach contents might contain considerable quantities of alcohol, and other organs, such as the liver, indicate alcoholic poisoning.

### 4. Blood Diseases.

Smears on clean slides should be taken both from the heart blood and from all the organs concerned in blood formation and blood destruction, such as the bone-marrow, spleen, lymph glands, thymus (if present), and liver. It will also be necessary to take portions of these organs and fix them in 4 per cent. formaldehyde for histological section by the paraffin method. Certain of these diseases are caused by parasites or infectious, such as the anæmias from dibothriocephalus latus and anchylostomiasis; the blood parasites such as malaria cause severe anæmias. Syphilis is sometimes associated with a leukæmic condition of the blood.

### 5. Post-mortems in Private Houses.

Under these conditions the difficulty of making a complete examination is increased because of lack of proper sinks, &c., and because all soiling of the

contents of the room must at all costs be avoided; nevertheless, all parts of the body can be examined as in routine post-mortems, though it takes a longer time to do as complete an examination.

To do a post-mortem on an ordinary bed is very difficult, and if a deal table or unhinged door supported at both ends can be procured the chance of soiling the room will be greatly lessened. All that is required from the house are a file of old newspapers, two or three pails, a good supply of hot and cold water, some towels and a piece of soap. The instruments should be carried in a bag large enough to accommodate a specimen such as the liver. These should at least include the following: narrow-bladed knife, brain-knife, large and small blunt-pointed scissors, saw, forceps, probe, india-rubber gloves, sponge, packing-needle and twine for sewing up the incision, and a piece of mackintosh for wrapping up any specimen brought away. Other instruments may have to be brought for special purposes, such as for making a bacteriological examination.

On entering the room a general survey should be made of the articles likely to be displaced, for the greatest possible care must be taken to leave everything as nearly as may be as it was found. Any flowers on the corpse must be carefully replaced, and if a candle burning on an altar be accidentally extinguished, as by a gust of wind, it should be relighted before leaving. Spread newspapers upon the table and on the floor at the sides; put one of the pails near the table on a newspaper. Uncover the corpse, and having taken off the clothing, place it on the table. The steps of the

examination are no different from other post-mortems except that, when there is no probability of disease in the throat or neck, the trachea and great vessels are severed at the top of the thorax in the removal of the heart and lungs. Organs can be opened and incised over the thorax and their cut surfaces sponged over the pail.

Any more careful dissections required are best done, if possible, in the post-mortem room by removing the whole organ at the conclusion of the examination.

The incisions are carefully sewn up when everything is finished, the body is sponged over with cold water, not omitting the back, which may have become soiled by blood trickling down the sides, and dried with a towel. Not until everything which the body is touching is quite clean is the clothing replaced, and the corpse put back upon the bed. Restore the attitude of the body, any trinkets and flowers, and see that no portion of the incision is visible when the clothes are arranged. Put all the bloody water, contents of organs, &c., into one pail, and put all soiled newspapers, well wrapped up so as not to expose the soiled parts, into another containing no water; they can then be burned. Before leaving the room arrange that the ventilation is sufficient to allay any unpleasant odour, and glance round to see that everything has been left in its place.

# CHAPTER VIII

## THE RESTORATION OF THE BODY AND THE PRESERVATION OF ORGANS

The greatest care must be taken in all cases to see that the external surface, general contour, and appearance of the body are preserved, and to ensure that the evidence of there having been a post-mortem examination can only be ascertained by the skin incisions, all of which, when the corpse is clothed, should be out of sight. As a general rule it may be stated that the face, the front of the eyeballs, hands and feet, breasts, and external genital organs should be untouched. If, for instance, the whole eyeball is wanted, it may be possible to insert an artificial eye; another method is to stitch the two eyelids together carefully, and imitate the natural bulging of the eyeball by wool in the orbit. When the posterior half of the eye only has been removed, restoration may be effected by stuffing the anterior half of the ball with a piece of wool soaked in ink, and packing the orbit so as to give the cornea the necessary proportion. But if it is desired to preserve a limb as a specimen, then it is better to get special permission from the relatives for its removal.

During the course of the examination the skin is almost certain to get stained with blood, fæces, or bile, which if left long enough might stain it, or be difficult to remove; the body, therefore, should frequently be

sponged down with cold water during the examination, and this should at least be done when all the organs have been removed.

Before replacing any of the organs, all the body cavities should be sponged out, so that they may be as dry as possible. The natural orifices in the pelvis should be firmly plugged with wool, to prevent leakage, and a wad of tow placed over them inside. The solid organs having been freed of any excess of fluid and blood, and the intestines having been emptied and cleansed, should be replaced in the body cavities as nearly as possible in their natural positions. The brain, after having been examined, is not easily sewn up in the cranial cavity, so it is usually placed in the thorax or abdomen. In highly infective bodies, such as anthrax, it may be desirable, in the interests of hygiene, to destroy as many as possible of the viscera, but this can only be done if a furnace is accessible. If infective organs are replaced in the body cavities, a strong antiseptic, such as 5 per cent. carbolic acid, should be freely used both internally and externally. Over the organs, thus replaced in the thorax and abdomen, should be put some tow, wool, or even newspapers, suitably folded, on which the sternum is replaced. The condition of the neck should be restored by a suitable piece of tow. The main incision is now ready for sewing up. Take a packing-needle and thread it with thin twine, use it double, knotted at the end, and about one-and-a-quarter the length of the main incision. The stitch used is called the glover's stitch, and is begun at the neck end of the incision. Pass the needle from the under to the upper aspect of the skin, each

puncture of the skin lying opposite the middle of the interval between two punctures on the opposite flap. The needle should pass through the skin about one-quarter of an inch from the cut surface, and each successive stitch should be about half an inch apart. While making the needle-punctures with the right hand the left should be used to keep the previous stitches taut by making slight tension on the thread ; and, as each stitch is made, the edges of the skin should be tucked in so that no raw surface, subcutaneous tissue, or fat shows on the surface. The pelvic end of the suture is finished off by retaining in the left hand one strand of the double twine, making another stitch on the opposite side, cutting the string at the needle, and drawing back through the last stitch-hole the strand retained in the left hand ; the two ends can then be tightly tied in a firm knot.

The cranial cavity having been cleansed is filled with tow or wool, or paper, and to restore the natural weight a small amount of sand tied up in a cloth. Some difficulty may be found in getting the calvarium to fit firmly on the rest of the skull ; this difficulty is overcome in one of two ways. If the temporal muscles are well developed, it will be sufficient to suture together on either side the two parts which have been severed in removing the calvarium. If these muscles are feebly developed, then two holes should be bored in the skull cap, and through the bone immediately opposite to it on either side, and the calvarium retained either by wire or strong twine. It will assist the fixation if the scalp be stitched tight over the head, which can be done if a strip of scalp is cut off one flap so as to prevent any overlapping ; for in the manipulation of turning back

the scalp to remove the brain, the scalp is unduly stretched. The method of stitching up the scalp is the same as for the main incision. The transverse ridge across the forehead, which is left by a faulty fixation of the calvarium, is very noticeable, and should entirely be avoided.

The laminæ and spines removed in the exposure of the spinal medulla should be replaced, the muscles attached to the skin moulded over them, and the incision closed in the same way as the abdominal incision. All the other incisions should be similarly closed up, and the body sponged all over.

If a portion of the vertebral column has been removed, the rigidity of the body is best restored by inserting a piece of a stout stick longer than the length of vertebral column removed, in the vertebral canal, so as to bridge over the gap, and then pouring in plaster of Paris, so as to fill up the gap in the bones. Additional support may be given by placing two short laths, their middle parts embedded in tow, on either side of the vertebral bodies, bridging over the gap, and pouring over them more plaster of Paris.

Long bones, if moved, will have to be carefully replaced by wooden sticks, wrapped round with tow, so as to imitate the natural configuration of the bone. The upper and lower ends will have to be fixed as firmly as possible to the adjacent bones.

## Preservation of the Specimens in Bulk.

For this purpose the method used is that known as Kaiserling's. The portion of tissue to be preserved is placed in a mixture of—

| | |
|---|---|
| Formalin (Formaldehyde 40 per cent.) | 200 c.c. |
| Water . . . . . | 1,000 c.c. |
| Potassium nitrate . . . . | 15 grm. |
| Potassium acetate . . . . | 30 grm. |

The length of time required for fixation depends on the size of the specimen, and the thickness of the tissue. The process can be hastened by making needle-punctures into the tissues over parts whose surface is not required for display purposes. The stage of fixation can be determined by feeling the tissue, which is soft if unfixed but harder if fixed, and with a little practice the presence of unfixed portions of organs can be detected.

When completely fixed, place the organ in 90 per cent. alcohol until the natural colour is restored. The length of time again varies, and depends on whether the alcohol has been previously used or not. It is convenient to have two large jars of alcohol, and to place the organ first in the older specimen, and later to complete the restoration of tint, in fresher alcohol. The tissue should remain in alcohol only so long as is necessary to bring back the colour, and never longer than 48 hours. After being in the formalin mixture, the surface for exhibition should be prepared by making a fresh surface with the knife, so that it can be watched during the colouring process. The organ may then be preserved in a mixture of—

| | |
|---|---|
| Glycerine . . . | 400 c.c. |
| Acetate of potassium . | 200 grm. |
| Water . . . . | 2,000 c.c. |
| Carbolic acid . . | 2·6 grm. |

# INDEX